VOLUME 29 NUMBER 2

The Journal

OF THE

AMERICAN DENTAL ASSOCIATION

FEBRUARY 1942

CONTENTS

Ernest G. Sloman, D.D.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

Partial Dentures.
Luzerne G. Jordan, D.D.S. 169
Localized Vertical Growth Disturbance.
D. D. Glucksman, D.D.S. 184
The Philosophy of Nutrition as Related to Dental Disorders.
Morris L. Drazin, M.D. 187
Prevention in the Practice of Operative Dentistry.
Robert E. Blackwell, D.D.S., M.S. 196
Relationship Between Gingival Hyperplasia and Ascorbic Acid in the Blood and Urine of Epileptic Patients Undergoing Treatment with Sodium 5, 5-Diphenyl Hydantoinate.
Jerry A. Millhon, D.D.S., and Arnold E. Osterberg, Ph.D. 207
Race Betterment Through Preventive Dentistry.
Weston A. Price, D.D.S., M.S. 213
Oral Manifestations of Local and General Diseases.
Kurt H. Thoma, D.M.D. 222
How Valuable Are Your Eyes?
C. W. Adams, D.D.S. 233
Correlated Radiodontic Service in Medical and Dental Practice.
Clarence O. Simpson, M.D., D.D.S. 239
Bactericidal Effects of Some Drugs Used in Pulp Canal Therapy.
John R. Pear, M.S., D.D.S. 244
Bilateral Cleft-Lip Reconstruction.
Louis W. Schultz, D.D.S., B.S., M.D., F.A.C.S. 248
Inlay Patterns by the Wax Gun Technic, with Observations on Physical Changes in Waxes.
W. L. Wylie, B.S., D.D.S. 251
Controlled Use of an Abrasive in Occlusal Surface Adjustment.
J. Lewis Blass, Ph.G., D.D.S. 259

EDITORIAL DEPARTMENT

Journalistic Ethics 263

Bibliographical 266

ASSOCIATION ACTIVITIES

President's Message—Bureau of Public Relations—Council on Dental Therapeutics—Council on Dental Education—Committee on Dental Preparedness—Research Commission—Committee on Economics—Committee on Legislation—State Society Officers' Conference—Five State Post Graduate Clinic—Mobile Dental Clinic Presented to Royal Canadian Dental Corps—American Dental Association Membership—Endowment Fund for the Journal of Dental Research—Correspondence—Request for Aid in Identification ..... See Special Contents for Association Activities, page 269

OBITUARIES

B. Frederick Philbrook, D.D.S. (1853-1941) 313
Deaths 314

INCIDENTS OF PRACTICE

Method of Bringing into Position an Overretained Impacted Upper Right Central Incisor.
Samuel R. Siegel, D.M.D. 317
Salvaging Silver Alloy and Mercury. Ben Dent, D.D.S. 319
Heredity and Anodontia. Fred Carmosin, D.D.S. 319
Sensitive Gingival Cavities. A. E. Belanger, D.D.S. 319

Current Literature 320
Announcements 324

ADVERTISEMENTS

Index to Advertisements A-61
Classified Section A-50

The Journal of the American Dental Association. Vol. 29, No. 2. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $5.00. Single copy fifty cents. Entered as second-class matter, January 30, 1939, at the postoffice at Chicago, Ill., under the act of August 24, 1912. Published monthly. Copyright, 1942, by the American Dental Association.

AMERICAN DENTAL ASSOCIATION

OFFICERS AND BOARD OF TRUSTEES (1941-1942)

OREN A. OLIVER, President, Ex-Officio.....Medical Arts Bldg., Nashville, Tenn.
J. BEN ROBINSON, President Elect, Ex-Officio.....42 S. Greene St., Baltimore, Md.
HARRY B. PINNEY, Secretary, Ex-Officio.....212 E. Superior St., Chicago, Ill.
R. H. VOLLAND, Treasurer, Ex-Officio...First Capital Nat'l Bank Bldg., Iowa City, Iowa
E. G. MEISEL, '44.....121 University Place, Pittsburgh, Pa.
HOWARD C. MILLER, '44.....55 East Washington St., Chicago, Ill.
C. J. WRIGHT, '44.....American State Bank Bldg., Lansing, Mich.
EDWARD J. JENNINGS, '44.....126 West State St., Trenton, N. J.
CLYDE E. MINGES, '44.....Rocky Mount, N. C.
PHILIP E. ADAMS, '43.....106 Marlboro St., Boston, Mass.
H. B. WASHBURN, '43.....488 Lowry Bldg., St. Paul, Minn.
HOWARD E. SUMMERS, '43.....1015 First Nat'l Bank Bldg., Huntington, W. Va.
CARLOS H. SCHOTT, '43.....1004 Neave Bldg., Cincinnati, Ohio
HARVEY J. BURKHART, '42.....Box 879, East Avenue P. O., Rochester, N. Y.
FRED J. WOLFE, '42.....Maison Blanche Bldg., New Orleans, La.
RUSSELL A. SAND, '42.....Fargo, N. D.
D. W. MCLEAN, '42.....2585 Huntington Drive, San Marino, Calif.

STANDING COMMITTEES (CHAIRMEN)

JUDICIAL COUNCIL.....Ernest G. Sloman, 344-14th St., San Francisco, Calif.
COUNCIL ON DENTAL EDUCATION..Minor J. Terry, State Education Building, Albany, N. Y.
PUBLIC HEALTH AND EDUCATION.....F. C. Cady, U.S.P.H.S. Hospital, Lexington, Ky.
DENTAL LEGISLATION.....A. B. Patterson, Morris Bldg., Joliet, Ill.
RELIEF COMMISSION.....Charles P. Grosby, 317 N. 11th St., St. Louis, Mo.
DENTAL RELIEF FUND.....Fred R. Adams, 55 W. 42nd St., New York, N. Y.
RESEARCH COMMISSION.....M. D. Huff, Medical Arts Bldg., Atlanta, Ga.
PROCESS PATENT.....M. D. K. Bremner, 55 E. Washington St., Chicago, Ill.
LIBRARY AND INDEXING SERVICE.....John E. Gurley, 350 Post St., San Francisco, Calif.
NATIONAL BOARD OF DENTAL EXAMINERS.....James E. John,
Medical Arts Bldg., Roanoke, Va.
MEMBERSHIP.....Paul W. Zillman, 29 Walden Ave., Buffalo, N. Y.
INSURANCE.....A. D. Weakley, 1029 Vermont Ave., Washington, D. C.
ECONOMICS.....R. M. Walls, 48 E. Market St., Bethlehem, Pa.
COUNCIL ON DENTAL THERAPEUTICS.....Harold S. Smith,
180 N. Michigan Blvd., Chicago, Ill.
AMERICAN RED CROSS.....B. Lucien Brun, 827 Park Ave., Baltimore, Md.
HISTORY.....B. W. Weinberger, 119 W. 57th St., New York, N. Y.
DENTAL MUSEUM.....Henry A. Swanson, 1726 Eye St., N. W., Washington, D. C.
NATIONAL HEALTH PROGRAM COMMITTEE.....Leroy M. S. Miner,
363 Marlborough St., Boston, Mass.

ERNEST G. SLOMAN, D.D.S., San Francisco, Calif.
Second Vice President of the American Dental Association

THE JOURNAL
of the
AMERICAN DENTAL ASSOCIATION

Vol. 29 FEBRUARY 1942 No. 2

PARTIAL DENTURES

By LUZERNE G. JORDAN, D.D.S., Washington, D. C.

PARTIAL denture construction, one of the most interesting phases of dental practice, is in no way a difficult procedure, although, in some cases, it may be a lengthy one. It is especially applicable to general practice because so many different types of dental service may be involved in making a successful partial denture.

Although partial denture construction may, for the purpose of study, be divided into several different phases, there is a definite relation of each to all the others, and a successful end-result is evidence of an orderly predetermined course of procedure in which each operation is performed to harmonize with the requirements of the finished prosthesis.

Partial denture construction, which is to a degree an engineering problem, must of necessity be influenced by the biologic and physiologic laws governing the anatomic structures involved. The engineering features are simple of application, but the physiologic and biologic laws involved demand knowledge which can be expected only from those who have had special training in dentistry.

Partial denture construction is a responsibility of the dental profession and cannot be assumed by laymen. Technical assistance in the mechanical procedures of construction may be used to advantage, but the relegation to others of such vitally important phases as partial denture design is in my opinion a great mistake, and yet this is only one of the many important details which are often left entirely to the discretion of a dental technician. Partial denture construction offers an opening to those who might wish to encroach upon the field of dental practice, and if this should ever occur, the dental profession will not be blameless.

A more intensive study of the subject of partial denture construction and a more nearly complete assumption on the part of each dentist of his full responsibility in this particular field of dental practice would, I am sure, improve the type of service being rendered.

What is a partial denture? A partial denture is a removable prosthetic appliance designed to replace a partial loss

Read before the Chicago Dental Society.

of natural teeth and contiguous tissues in a single dental arch. All removable prostheses can be classified as partial dentures, whether supplied with external attachments, such as clasps, or with internal precision attachments. This designation eliminates the confusion attending the use of such terms as removable bridges, movable-removable bridges and partial dentures, bringing them under one heading, to be designated as partial dentures with internal attachments or partial dentures with external attachments.

There is a difference, however, in many of the procedures involved in the construction of partial dentures with external attachments or clasps and those involved in the construction of dentures with precision attachments. Statements made here will refer only to partial dentures with external attachments or clasps.

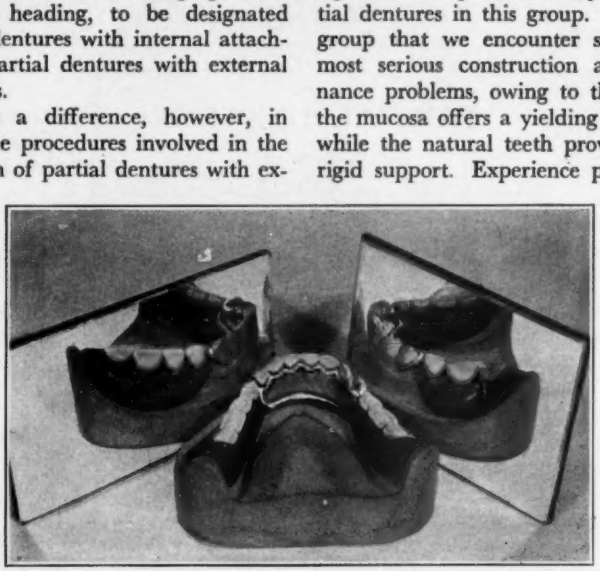


Fig. 1.—Tooth-and-mucosa-borne type of partial denture. The continuous clasp serves as an indirect retainer, and also distributes lateral occlusal stress to the remaining natural teeth, thus increasing partial denture support.

CLASSIFICATION

Partial dentures may be classified according to the nature of their support as tooth borne, tooth and mucosa borne or mucosa borne.

Tooth-borne partial dentures are those that receive their principal support from the remaining natural teeth, and when properly constructed are without doubt the most satisfactory type. Partial dentures with external attachments (clasps) should be of bilateral and not unilateral design.

Tooth-and-mucosa-borne partial dentures are those receiving their support from the mucosa as well as the remaining natural teeth. Proper denture design seems to place the majority of partial dentures in this group. It is in this group that we encounter some of the most serious construction and maintenance problems, owing to the fact that the mucosa offers a yielding foundation, while the natural teeth provide a more rigid support. Experience proves, however, that the natural teeth should be utilized to the greatest possible extent, but advisedly, of course, in providing partial denture support. (Fig. 1.)

Mucosa-borne partial dentures, those depending primarily on the mucosa for their support, are the least satisfactory of the three types. Partial dentures without occlusal rests or those on which stress breakers are used on all abutment teeth are primarily mucosa borne.

CONTRAINDICATIONS

Although they offer many possibilities

in the field of restorative dentistry, partial dentures do have certain limitations, and for this reason their use is in some cases definitely contraindicated. In my opinion, they should never be used where fixed bridgework could possibly be used advisedly.

Since the advent of the one-piece casting technic, there has been a gradual decrease in fixed-bridge construction and a marked increase in the use of unilateral partial dentures with external attachments for filling edentulous spaces. Such partial dentures are in no way comparable to properly constructed fixed bridges for the restoration of masticatory efficiency, occlusal alinement or the maintenance of edentulous ridge form;

Fig. 2.—Study cast mounted in surveying instrument so that vertical upright is parallel to principal vertical occlusal stress, this being accepted as direction of insertion of proposed partial denture. The teeth should be altered if necessary to make such a direction of insertion possible. The extreme convexity on the mesial surface of the molar should be reduced and better retention be provided for the buccal clasp arm. This may be accomplished by tooth preparation and restoration with a complete crown. Such undesirable conditions should be discovered during the diagnosis.

and their promiscuous use has, in my opinion, often been detrimental to oral health and professional prestige. The fulcrum line or axis of rotation in such cases is through the occlusal rests, and considerable movement of the restoration is possible, especially during lateral jaw excursions. If a unilateral removable restoration instead of a fixed bridge is indicated, precision attachments should be used or a stabilizing leverage in the form of a lingual or palatal bar should be extended to the opposite side of the arch.

When economically possible, fixed bridgework should often be used to restore lost anterior teeth, even though missing posterior teeth are being restored on a partial denture.

Partial dentures are also contraindicated where few natural teeth remain and the cost of mouth preparation to permit satisfactory partial denture construction, together with proper future servicing, would prove a financial hardship to the patient; or where the patient has little appreciation for his own natural teeth and evidences a definite lack of dental care. In both cases, the patient would probably be better served with complete dentures.

Partial dentures are contraindicated in those cases in which the patient refuses to submit to proper preparation of the mouth previous to impression making. The tooth contours, inclinations or other conditions may require definite alteration before a successful restoration can be expected.

It being impossible to cover the subject of partial dentures in a single essay, I have elected to present an outline of partial denture procedure which I have found useful in my own practice for many years, and very practical in student clinic practice.

EXAMINATION

The examination should be a thorough one, with the health of the patient the primary consideration.

Well-made roentgenograms, including bitewing films, together with complete vitalitest records, are indispensable.

An accurate record should be made of all carious teeth as well as the condition

of the gum tissues and general physical condition of the patient. Questionable restorations in the natural teeth should be removed to determine more accurately the advisability of individual tooth retention. Centric and eccentric occlusion, together with occlusal alinement, should be carefully observed in the mouth. If an increase of the vertical dimension seems advisable, a tentative biteblock may be made in the mouth and later used in examining the study casts.

The age of the patient, together with his expectations and previous denture experience, if any, may all have a bearing upon the diagnosis.

Esthetic factors, such as the profile and high and low lip lines, should be carefully noted since they may have an important bearing on the diagnosis, and particularly on denture design.

The value of well-made study casts cannot be overestimated. They should be produced in artificial stone from well made hydrocolloidal impressions.

They should represent an accurate reproduction of all tooth contours and inclinations as well as the edentulous areas as they exist in the mouth. In most cases, the casts should be properly related in an articulator. All other information of value in making a complete diagnosis should be obtained.

Fig. 3.—Unopposed natural teeth. These usually extrude and often require extraction to permit partial denture construction. Any necessary alveolectomy should be performed at the same time to avoid a second operation, as was necessary in this case.

DIAGNOSIS AND TREATMENT PLANNING

The diagnosis, which is based on the correlated data obtained in the examination, should be followed by a complete plan of procedure wherein the mouth is first considered from the standpoint of health. Foci of infection should be removed; periodontal corrections be made if indicated, and carious teeth be supplied with restorations. Faulty occlusion also requires correction.

Teeth to be extracted should be removed from the study casts and the casts should then be positioned in a suitable surveyor for a study of the natural tooth contours and inclinations as related to the most desirable path of insertion of the partial denture. Undesirable tooth contours or inclinations are thus located. The absence of clasp retention areas on proposed abutment teeth as evidenced by the survey may necessitate metallic restorations, in which such retention areas may be properly established.

A tentative outline or design of the proposed partial denture is made upon the study casts and used as an aid in formulating the many conclusions which are the basis of the final diagnosis.

Partial denture design is influenced by the conditions presented in the individual case, but proper design itself may indicate certain changes in those conditions. As an example, the form and inclinations of one or more natural teeth may require alteration to provide support and retention of the prosthesis or to allow its easy removal or insertion

without trauma. (Fig. 2.) A well-designed case may also require the use of metallic restorations even in the absence of caries, to permit of occlusal rest areas or clasp arm retention. Esthetics may influence the design to the extent of requiring special preparation of abutment teeth or a special type of retainer instead of a clasp.

A summary of the diagnosis should consist of a complete outline of all surgical and operative procedures incidental to rehabilitation of the mouth from a health standpoint, and as a suitable environment and foundation for the partial denture that is to be constructed.

Fig. 4.—Extensive restoration of natural teeth should be made by the indirect method. Metal dies of the prepared teeth positioned in a cast of the whole arch are placed in a surveying instrument where the lateral surfaces of the restoration, in wax, are carved to desired form.

CONSULTATION WITH THE PATIENT

After the diagnosis as previously suggested, the dentist is in a position to present the patient's dental problem in a manner that not only establishes confidence, but also results in a mutual understanding regarding work to be done, as well as the time and economic factors involved. Partial denture construction often necessitates more mouth preparation than the patient had anticipated.

Study casts are useful in indicating any necessity for special mouth preparation.

PREPARATION OF THE MOUTH

Preparation of the mouth previous to the making of final impressions is, in partial denture construction, one of the primary essentials to the health and preservation of the anatomic structures, as well as to the success of the finished prosthesis. It is one of the most important phases of partial denture construction and probably the one most frequently neglected. All restorations or alterations made upon the natural teeth should, when possible, be carried out in such a way that they simplify partial denture construction and contribute to its success as a dental restoration.

A thorough prophylaxis, with removal of calcareous deposits, followed by instructions and a demonstration of care of the mouth should precede all surgical operations.

Bulbous tuberosities or pronounced ridge convexities that would interfere with base or saddle construction should be corrected by alveolectomy.

Balancing the occlusion of the remaining natural teeth should be planned or accomplished before any dental restorations are considered. Balanced occlusion contributes to oral health, comfort and efficiency, whether the patient has all of the natural teeth or is wearing partial or complete artificial dentures. The importance of balanced occlusion cannot be overemphasized.

If balanced occlusion is to be expected when the partial restoration is completed, balanced occlusion of the remaining natural teeth must be assured by grinding or by suitable restorations before partial denture construction is started, and especially before final impressions are made. This rule also ap-

plies to other types of dental restorations involving the natural teeth whether individual tooth restorations or fixed bridgework.

Tooth contours may often be corrected by grinding, but when such grinding would remove the enamel, metallic restorations should be made.

Ample occlusal rest areas should be provided on the abutment teeth in order that the occlusal rests on the finished prosthesis may be of sufficient strength to serve their intended purpose and not cause occlusal interference. In some instances, the occlusal surface of the natural tooth may be altered slightly and the tip of the opposing cusp be slightly reduced, by grinding, but the ideal rest areas are those which are established in metallic restorations on the abutment teeth. The occlusal rest area should provide a positive seat for the occlusal rest so that occlusal stresses applied to the denture will not result in displacing influences upon the abutment tooth or denture. Occlusal rests should not be placed upon sloping surfaces.

If one or more anterior teeth are to be supplied by the partial denture, the natural teeth approximating the edentulous area should be provided with metallic restorations in which definite occlusal rest areas have been made, and this part of the denture should be strictly tooth borne.

The floor of rest areas should be at right angles to the vertical stresses at least, but they serve even better when inclined slightly toward the center axis of the tooth.

The crowns of some natural teeth present lateral surfaces which converge occlusally, thereby offering no possible clasp arm retention. If used as abutments they should be provided with metallic restorations in which concavities suitable for clasp arm retention may be established. Complete metal crowns properly shaped serve admirably.

We occasionally encounter a short, partially erupted posterior tooth which in the roentgenogram is found to be of average length and presenting a crown of normal size and contour. If the tooth

Fig. 5.—Master casts with metal teeth offer many advantages over all stone casts. A narrow intermaxillary space in the region of the upper left second molar made an all metal occlusal surface necessary. This was carved as a part of the other metal framework after the investment cast was mounted in the articulator. The buccal flanges of both saddles were shortened because of a high lip line, and the buccogingival edges of the bicuspids were made to contact the mucosa. The continuous clasp acts as an indirect retainer and increases support of the restoration by distributing the lateral occlusal stress to the natural teeth.

is desired as an abutment, the excess gum tissue may be surgically reduced, to expose the crown of the tooth.

Natural teeth presenting abnormally long axis inclinations are detrimental to partial denture construction and usefulness. If their retention is considered advisable, full crown restorations that are more in harmony in alinement with the other teeth should be made.

Unopposed natural teeth usually extrude or move toward the opposite jaw, in an attempt to reestablish occlusion, and this change in tooth position is often accompanied by a like change or further growth of the osseous structures surrounding their roots. (Fig. 3.) Many bulbous tuberosities found at the posterior aspect of edentulous upper ridges are a result of this process. The retention of such teeth will depend on the extent of extrusion. If a reasonable amount of occlusal grinding will not bring about the desired occlusal alinement or provide sufficient intermaxillary space for denture construction, the teeth should be removed. Study casts of such a case offer an excellent means of demonstrating to patients the value of early restoration of lost natural teeth.

Posterior abutment teeth presenting caries, especially on the gingival surfaces, should be restored with full crowns.

If a continuous clasp is to lie along the lingual surface of posterior teeth which are to be restored, as by full or three-quarter crowns, shelves or shoulders should be carved in the lingual surfaces of the crowns. The continuous clasp is later constructed to fill in the carved out area, and thus its presence does not add bulk to the lingual surface of the teeth and interfere with the tongue space. This type of construction also enhances retention and provides additional support to the prosthesis.

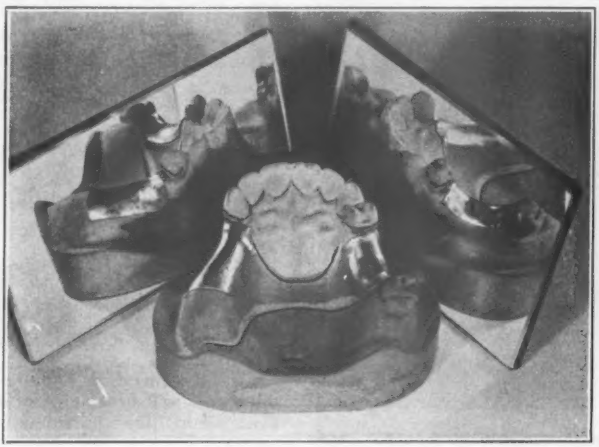


Fig. 6.—Edges of palatal bars should make intimate contact with the mucosa over which they lie. With the patient present, the cast is scraped along the bar outline in accordance with the resiliency of the soft tissues. This cast has also been made ready for the duplication impression for making the investment cast.

If there is to be an increase in vertical dimension with restoration of the remaining natural teeth, it should be made in conjunction with balancing the occlusion.

In all restorations of individual teeth, the shape should simplify insertion and removal of the finished denture, as well as furnish proper occlusal rest areas and clasp arm retention surfaces. A survey-

ing instrument is of great value when such restorations are made by the indirect method. A cast of the entire arch bearing the dies upon which the restoration is to be made is arranged on the base of the surveyor according to the desired path of insertion of the finished denture. As the restoration is made in wax, the desired shape is given the prosthesis, as indicated by the surveying instrument. (Fig. 4.)

Although we may agree that the mouth should be completely prepared before the final impressions are made, we must admit that this is probably the most

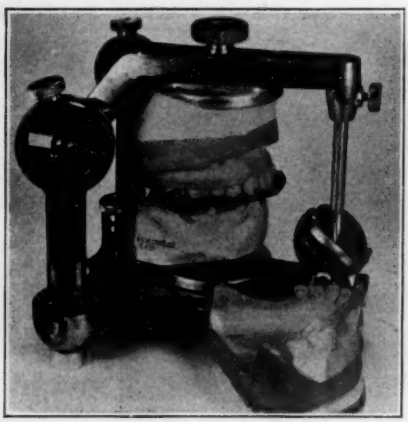


Fig. 7.—Metal-surfaced wax record made between master casts in articulator and used for mounting the investment cast.

neglected phase of present-day partial denture construction.

IMPRESSIONS

With the many materials available for impression making, the choice of a technic is, of course, the first consideration. A final impression in partial denture construction should be more than an accurate copy of the natural teeth and related soft tissues, in a state of rest. An accurate copy of the teeth is essential in all cases, but the soft tissues that may be utilized for any portion of the partial denture foundation should, in my opinion, be recorded in a state of functional displacement.

This may be accomplished with sectional compound impressions, and with certain technics utilizing both modeling compound and hydrocolloidal material, or with the use of plaster of Paris or zinc oxide and eugenol paste in especially prepared trays similar to those used in immediate full denture construction, or by other methods.

If compression of the mucosa is not accomplished during impression making, rebasing should be done either during the procedure or after the denture is

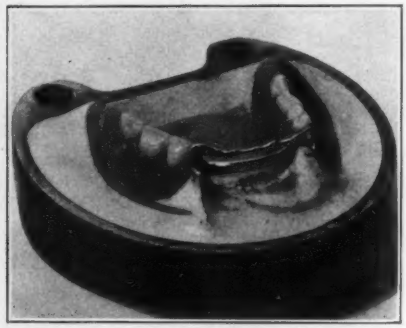


Fig. 8.—Investing cases so that metal framework will be on side of flask with artificial teeth. This procedure has many advantages.

made, but before delivery to the patient.

When a partial denture is being made for one jaw only, accurate impressions of the opposing occlusal surfaces already present in the mouth may be made with plaster of Paris or with modeling compound as described in a previous article. If the partial denture is to be opposed by a new full denture, the two should be made at the same time.

The subject of impressions has been treated in greater detail in a previous article entitled "Sectional Impressions in Partial Denture Construction."[2]

CASTS

If the impression method used did not permit immediate checking for accuracy, as is possible with sectional compound impressions, the cast should be checked by means of an index or check block made on the cast and tried in the mouth.

The cast should be sufficiently strong to resist mutilation and thus permit the construction of the entire restoration without returning to the mouth for new assembly impressions.

If the entire cast is made of artificial stone, the abutment teeth should be reinforced with thin brass screws in filling the impression, and great care should be used throughout all denture construction procedures to prevent its mutilation.

The most useful casts are those in which the natural teeth are represented in metal, preferably silver amalgam, and the body of the cast in artificial stone. Metal teeth are especially indicated where remaining natural teeth stand alone in the arch or when wrought clasps are to be constructed.

The amalgam teeth should be removed before flasking the case for curing plastic base materials, or an artificial stone duplicate of the entire cast should be used.

MOUNTING THE CASTS IN THE ARTICULATOR

Casts of the upper and lower jaw should be mounted in the articulator before making the metal framework, whether wrought or cast, in those cases in which (A) occlusal rests are to be opposed by natural teeth; (B) porcelain facings or tube teeth are to be used (Fig. 5); (C) any occlusal surface is to be supplied by the metal framework or casting (Fig. 5), or (D) the vertical dimension is to be increased (bite opened) on the casting.

If the partial denture is to supply all posterior teeth in one jaw and a complete artificial denture is being constructed for the opposite jaw, mounting may be delayed until the metal framework has been constructed, if desired.

FACEBOW RECORD

The maxillary cast is mounted in the articulator by the aid of a facebow record. If the maxillae are to be supplied with a full artificial denture, the facebow fork is inserted in the occlusal rim as usual. If all natural posterior teeth in one or both jaws are missing, baseplates with occlusal rims are first constructed. A roll of wax is formed on the facebow fork and the patient is directed to bite into, but not through the wax. All wax on the maxillary side is cut away except the indentations of the occlusal surfaces or occlusal rims, and the maxillary cast is seated for mounting in the articulator.

Fig. 9.—Stone or metal teeth previously removed from master cast are seated in finished prosthesis and cast poured in plaster. This is useful in mounting the finished prosthesis in the articulator for refinement of the occlusion and also as a check on whether the prosthesis may have been distorted while in the patient's possession.

RELATING THE MANDIBULAR CAST TO THE MAXILLARY CAST

In complete artificial denture construction, the mandibular cast is mounted on the articulator in its unstrained centric relation to the maxillary cast at the accepted vertical dimension, and the artificial teeth are arranged in centric occlusion. This results in a state of harmony between centric jaw relation and centric occlusion.

A study of natural dentures reveals, however, that centric occlusion of the natural teeth is not always associated with centric jaw relation and therefore the recording of jaw relations in partial denture construction must receive special consideration. The establishment of harmony between the occlusion and the jaw relations is desirable, but it is not always practicable. If determined upon, it must be accomplished on the opposing natural teeth during mouth preparation and before impression making.

If one jaw is to receive a full artificial denture or if all posterior teeth are missing in one or both jaws and are to be restored with partial dentures, an unstrained centric jaw relation record may be made in the mouth and used for mounting the mandibular cast in the articulator in a manner similar to that recommended for immediate complete dentures.[1]

When opposing natural posterior teeth are present and the vertical dimension is not to be increased by the partial denture, the mandibular cast should be related to the maxillary cast in the articulator, so that the opposing posterior teeth come into normal centric occlusion. In other words, the mandibular cast is related to the maxillary cast according to the centric occlusion of the remaining posterior teeth, and not according to a jaw relation record made between the teeth in the mouth.

The occlusion presented by the partial denture must harmonize with that of the remaining natural teeth.

If the remaining opposing teeth are widely distributed in their respective arches and permit a stable relation of the upper and lower casts when occluded, the lower cast is fastened to the upper in this relation and mounted on the articulator. If only a few opposing posterior teeth remain, baseplates and rims must be used, but their occlusion with the opposing jaw should in no way interfere with the centric occlusion of the remaining natural teeth. In other words, no recording material of any kind should be placed between the occlusal surfaces of the natural teeth in these cases.

ADJUSTING THE ARTICULATOR

If all posterior teeth in one or both jaws are being restored with partial dentures or if a complete artificial denture is being constructed for one jaw, a protrusive jaw relation record should be made in the mouth and used to adjust the condyle guides of the articulator.[1] If a wide distribution of natural teeth remains in both jaws and they present occlusal balance in the mouth before the impression is made, the condyle guides are adjusted by occluding the casts in the desired relations.

The incisal guide may be adjusted by placing the casts in protrusive and right and left lateral relation to each other.

It should not be inferred from these remarks that all articulators can be adjusted to duplicate all possible jaw movements and thereby duplicate all possible static jaw relations. They do serve a very practical purpose, however.

ALTERATION OF THE MASTER CASTS

We refer again to the treatment plan and denture design decided upon in the diagnosis. With the patient present, we may alter the casts as requirements indicate.

If a partial upper denture is to cover the entire palate and terminate posteriorly as would a full denture, the posterior border area should be postdammed

on the cast as in complete denture construction.[1]

If a horseshoe design is used, its inner border outline should be scraped slightly on the cast as indicated by the resiliency of the underlying tissues as presented in the mouth. This procedure is similar to postdamming.

The exposed portion of palatal bars should make intimate contact with the soft tissues over which they lie, and this intimacy of contact should be increased slightly along the edges by scraping the cast, similarly to the postdam for a full denture. (Fig. 6.) The tissues which will underlie the finished bar should be tested for resiliency. Where very resilient, the cast should be carved deeper than at other areas. The border dam should not be allowed to approach the free gingiva of any tooth closer than one quarter inch. Cast bars require polishing of the under surfaces, and a slight border dam over hard areas is therefore advisable and, when properly constructed and maintained, will not cause trauma.

DIVISION OF PROCEDURE

The procedure from this point to the adaptation of temporary baseplates will depend on the type of metal construction to be used; that is, assembled wrought framework or cast framework.

When wrought clasps or an assembled wrought framework is to be used in conjunction with plastic base materials and porcelain teeth, without involving casting procedures, the work may be done primarily upon the master casts already mounted in the articulator.

The various parts of the framework, such as clasps and bars, are prepared and seated in their respective positions on the master cast. Occlusal rests or other areas involved in the occlusion should be properly formed by occluding with the opposing cast in the articulator. Assembly impressions are made with plaster of Paris. The metal parts are seated in the impressions, which are then filled with a soldering investment material. When the impressions are removed, the model maintains the metal parts in their proper relations for soldering procedures.

After the finishing and polishing, the framework is returned to position on the master cast, where it should fit accurately. The adaptation of temporary baseplates follows.

CAST METAL FRAMEWORK

Modern methods and materials permit the construction of one-piece castings, which offer many advantages over the assembled wrought metal framework for the majority of cases. The outline continues for cases involving castings.

PORCELAIN FACINGS OR TUBE TEETH

If porcelain facings or tube teeth are to be used, they should be prepared or ground to form and position on the master cast. If facings are to be used in the upper anterior region especially, it is advisable to scrape the cast slightly under the facing ridge lap. (Fig. 5.) This will assure future intimacy of contact between the facing and gum tissue. Such alterations should always be made before duplicating the prepared master cast in investment material.

Plaster cores are made to record the positions of the prepared facings or tube teeth on the master cast and are later used to establish identical positioning on the investment cast.

Some operators prefer to prepare the porcelain teeth or facings on the investment cast, but the master casts are sturdier and less liable to fracture. If finished work is to be returned to it, the master cast must be shaped to receive the work.

INVESTMENT CAST

All undesired undercuts on the master cast are blocked out with clayette or hard wax. Soft sheet metal of proper thickness is burnished onto the surface

of the cast where the finished casting is not to make contact with the mucosa, and also where a space between the casting and master cast is desired to permit attachment for a plastic base material. (Fig. 6.)

DUPLICATION OF MASTER CAST

Proper preparation of the master cast before duplication contributes much to simplifying the formation of the wax pattern as well as to finishing the metal casting. Four sticks of hydrocolloidal material dissolved in a pint of water, in a double boiler, makes an excellent duplication impression material and, with proper treatment, can be used many times. When softened in a double boiler, this material is poured over the wet master cast in a duplicating flask.

The duplication impression must be an accurate copy of the prepared master cast. It is filled with a mix of investment material, which, when crystallized, becomes the model upon which the metal framework design is formed in wax and against which the molten metal is later cast.

MOUNTING THE INVESTMENT CAST

When any part of the metal framework is to make contact with the opposing teeth or supply an occlusal surface, or when porcelain facings or tube teeth are to be used, the investment cast should be mounted in the articulator in the exact position occupied by the master cast. This is accomplished as follows:

The articulator is opened sufficiently to provide a space of at least 3 mm. between the occlusal surfaces of the master casts and the incisal pin is locked. Three or four half sheets of softened baseplate wax are superimposed one upon another to form a thick layer and the outside surfaces are covered with thin aluminum foil or heavy tin foil. This foil is placed on the occlusal surfaces of the lower cast and the articulator is closed on its centric axis until the incisal pin makes contact with the incisal guide. The wax is chilled and removed and the excess trimmed away. The metal surfaces will show only cusp tip indentations, which is all that is desired. The master cast that is to be replaced is removed and the investment cast seated in the metal surfaced wax record and attached in the articulator in the conventional manner. (Fig. 7.) The record is removed and the incisal pin released to permit occlusion of the investment cast with the opposing cast. The case is now ready for waxing. If both jaws are to receive partial dentures, both investment casts are mounted in the articulator. The master cast is retained on its mounting ring for later return to the articulator.

MAKING CASTING AND SEATING ON MASTER CAST

Facings or tube teeth are positioned on the investment cast by means of the plaster cores previously constructed on the master cast.

Waxing is completed and the occlusion established on the wax, and porcelain if present, by occluding the casts in the articulator. Occlusal rests should reestablish the occlusion, which was destroyed to make room for the occlusal rest. Occlusal surfaces to be furnished by the finished casting should be carved to form so that occlusal balance will be established.

Castings should be completely polished before trial on the master cast. Finished castings should never be taken to the mouth for trial unless they have first been found to fit the master cast, which, because of its rigidity, affords a better test of accuracy than the mouth itself. In addition, a successful finished denture requires correlations of casting, natural teeth, edentulous areas and artificial teeth, and this must of course be accomplished on the master cast. In other words, the master cast should be sufficiently accurate to permit the complete construction of the partial denture

without new impressions and casts. If castings fit the master cast, but not the mouth, it is proof that the impression was faulty.

The lengthy technical details involved in waxing, investing, casting and finishing must be omitted.

TRIAL OF METAL FRAMEWORK IN THE MOUTH

If the metal framework, wrought or cast, fits the master cast and establishes occlusion with the teeth on the opposing cast, it is ready for trial in the mouth.

If the mouth has been properly prepared and accurate impressions have been made, and the master cast and investment cast were not mutilated, the framework should fit accurately. If minor alterations, such as increased or decreased clasp arm tension, are indicated, the framework should first be softened. If major discrepancies are evident, a new impression should be made in the mouth and the casting should be remade. All parts of the metal framework involved in the occlusion should be carefully checked in the mouth, and occlusion with the opposing jaw should be assured.

ATTACHING THE PORCELAIN TEETH OR FACINGS

The framework, if soft, should be hardened by the treatment recommended for the alloy used. After boiling in acid to remove oxides, it is again polished.

If the restoration is an all metal and porcelain type, the porcelain teeth are placed in their respective positions and the occlusion with the opposing jaw is carefully checked. The teeth are then cemented to position and the case is ready for delivery to the patient. The outline continues for cases in which the saddle areas are to be made of plastic denture base materials. (Fig. 1.)

ATTACHING THE BASEPLATES

Temporary baseplates are made and attached to the metal framework on the cast, or, if preferred, the master cast may again be duplicated in artificial stone and plastic material bases constructed.

In either case, the bases should be firmly attached to the framework, and if the impression method used does not permit stability tests, the assembly should be taken to the mouth for such tests before arranging the teeth. If functional displacement of the soft tissues was accomplished in the impression, slight pressure will be necessary to completely seat the assembly. The clasp arm tips should permit the prosthesis to rise slightly when pressure is released.

ARTIFICIAL TOOTH ARRANGEMENT AND OCCLUSION

Artificial teeth of proper color and size are arranged to fulfil the esthetic requirements and establish the occlusion.

If all posterior teeth in both jaws are being supplied on partial dentures, the problem of establishing centric and eccentric occlusion is a simple one, because the posterior teeth in both jaws may be formed and arranged as required. The same is true when a partial denture is supplying all posterior teeth in one jaw, and is to occlude with a complete denture being constructed at the same time for the opposite jaw. When a partial denture in one jaw is to occlude with natural teeth in the opposite jaw, the problem is more complicated, because the factors of cusp height, compensating curve and plane of orientation are already established by the natural teeth. In these cases, ideal eccentric occlusion will be possible only when the occlusal surface structure and the alinement of the natural teeth permit. Thus the mounting of well-made study casts in the articulator and the analysis of such factors previous to starting partial denture construction.

It is not always practicable to produce an ideal environment for the partial restoration, but such should be our aim.

The distribution of balancing contacts in lateral or protrusive jaw relations with partial dentures present in the mouth may differ from that often acceptable with complete artificial dentures. In complete dentures, the occlusal arch is one solid unit, and three points of widely distributed occlusal contact, as described by Wilson, may often be accepted; but, with partial dentures present, the occlusal arch is not one solid unit and it is therefore advisable to establish occlusal contacts on all posterior teeth in all jaw relations, and thus stabilize the partial denture throughout its entire length. As an example, let us picture a partial denture supplying all lower posterior teeth and occluding with a complete denture in the upper jaw. If protrusive occlusion consists of contact only on the anterior teeth and second molars, the anterior part of the partial denture will tend to rise off the ridge, and a similar condition may exist on the balancing side in lateral jaw relation. Contact of all the posterior teeth would prevent this unfavorable condition.

The artificial teeth should be made reasonably narrow buccolingually. The teeth, after they have been satisfactorily arranged in the articulator, are tried in the mouth. If the case is a distal extension tooth-and-mucosa-borne type (Fig. 1) and functional displacement of the mucosa was accomplished in the impression, the artificial teeth should make slight premature contact. When biting pressure is applied, the partial denture should seat itself completely and all teeth then be in occlusion.

FLASKING, CURING AND FINISHING

If the master cast contains amalgam teeth, they should be cut away before flasking, or a duplicate of the master cast should be made in artificial stone for use in the curing process.

Partial dentures should be flasked when possible so that the metal framework is locked in the same side of the flask with the artificial teeth. Trial closures are thereby made easier and safer, and if the flask should fail to close completely, the relation between the metal framework and the artificial teeth is not lost, and rebasing of the saddles, after reduction of the ridge surfaces, will correct the error. To facilitate flasking, the stone teeth are cut from the master cast before flasking. (Fig. 8.)

To meet the requirements in partial denture construction, a plastic denture material must be strong and its color should harmonize with that of the natural gum tissues. Acrylic resin base materials seem to meet the requirements.

TRIAL OF THE FINISHED DENTURE

After packing, curing and polishing of the chosen material, the denture is ready for trial in the mouth. If the restoration is an extensively mucosa borne type and if functional displacement of the mucosa was accomplished in the impression, the artificial teeth on the denture will make slight premature contact; but when biting pressure is applied, the displacement of the mucosa is overcome and the occlusion should be established on all natural and artificial teeth, in centric or eccentric jaw relations. Malocclusion should be corrected.

The value of the mucosa in furnishing partial denture support will depend on the extent to which its functional displacement has been overcome by the time the occlusal rests are seated and the natural teeth make occlusal contact. Further occlusal pressure upon the prosthesis is then distributed to the natural teeth and the mucosa according to the design of the restoration. Upon release of the vertical occlusal pressure, the prosthesis should be free to move in the opposite direction sufficiently to permit the soft tissues to return to their rest form. For this reason, the free ends of clasp arms should not grip the abutment tooth too tightly but should permit a slight movement of the prosthesis ver-

tically away from the ridge. This movement, which is very slight, is present because of the difference in type of support furnished by the soft tissues and by the natural teeth. It is a functional movement of the prosthesis which should be considered in making the design upon the study cast. A direction of insertion should be selected which is parallel to the principal vertical occlusal stresses, and the mouth should be prepared on the basis of such a path of insertion.

Some recommended technics ignore this fact entirely, placing emphasis on selecting a path of insertion most favorable to retention against displacement away from the ridge. Too much emphasis has been placed upon designs for retaining partial dentures in position and not enough upon designs which will distribute the occlusal stress most favorably to the supporting structures.

The use of stress-breakers would of course simplify denture construction, but the natural teeth would not furnish their share of support in the finished restoration.

During masticatory function, the mucosa-borne portion of the partial denture should provide its share of occlusal resistance and aid in establishing occlusal balance throughout the arch. When biting pressure is applied, a portion at least of the so-called resiliency of the mucosa should be overcome by the time the occlusal rests are seated.

If the restoration is primarily tooth borne, it should present an occlusion which is simultaneous with that of the natural teeth.

This may explain more fully my preference for an impression method that records the soft tissues under pressure.

INDEX OR MOUNTING CAST

An index or mounting cast should be made in the finished partial denture. The master cast, even if preserved, can seldom be used where plastic materials are involved because of undercuts on the edentulous areas of the cast and also because of shrinkage of the plastic material. The teeth, metal or stone, which were removed from the master cast before flasking, are seated in their respective positions in the metal framework. The entire assembly is properly boxed; undercuts in the saddle areas are blocked out with clayette, and a cast is made of artificial stone or plaster of Paris. (Fig. 9.) This cast may be used later for mounting the partial denture in the articulator or as proof of its original shape if distortion occurs after delivery to the patient.

DELIVERY TO THE PATIENT

The patient is instructed in the removal and insertion of the denture and cautioned as to its fragile nature when out of the mouth.

Suitable brushes should be supplied and cleansing procedures demonstrated. The mouth should be examined frequently during the first few days of wear, and necessary corrections made before disturbing problems arise.

Extensive restorations should, after a few days' use, be mounted in the articulator for refinement of the occlusion.

The patient is again reminded of the temporary nature of partial dentures and the importance of frequent dental examinations and care as an aid in preserving the remaining natural teeth in a state of health.

BIBLIOGRAPHY

1. JORDAN, L. G.: Immediate Dentures. J.A.D.A., 25:868-884, June 1938.

2. *Idem:* Sectional Compound Impressions in Partial Denture Construction. J.A.D.A., 25:401-412, March 1938.

3505 Rodman Street.

LOCALIZED VERTICAL GROWTH DISTURBANCE

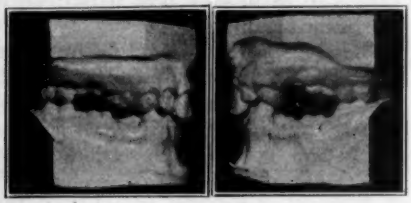
By D. D. GLUCKSMAN, D.D.S., New York, N. Y.

REPORT OF CASE

A GIRL, aged 10, had been free from all pathosis except a tonsillectomy performed at the age of 4. She was a well-developed, normal child.

The upper anterior teeth that had erupted, both central and the right lateral incisors, showed enamel hypoplasia. The mesiodistal relationship was good, but there was a deep overbite. (Fig. 1.)

The occlusion in the areas occupied by the upper and lower deciduous molars had been seriously interfered with. So peculiar, in fact, was the position of the upper left first deciduous molar that it gave the appearance of an erupting premolar. All eight deciduous molars seemed to have been left behind in the process of growth; i. e., vertical growth in the permanent molar area was continuing normally as evidenced by the occlusion of the permanent first molars and by the facial appearance of the patient. However, in the area occupied by the deciduous molars, there was no occlusal contact, the space between the upper and lower right deciduous molars being 6 mm. and the space on the left side 10 mm.



A B

Fig. 1.—A, right side, showing lack of occlusion of lesser degree than that in B, which shows separation of 10 mm. between upper and lower first deciduous molars. B, upper left first deciduous premolar, almost impacted.

X-ray examination (Fig. 3) revealed the congenital absence of the upper left lateral incisor, the upper right second premolar and the lower left second premolar. The lower right second premolar showed no root formation.

COMMENT

This localized lack of occlusion has been referred to frequently as a condition of submerged or submerging teeth. What seems to take place is a localized interference with eruption in the deciduous molar area and a normal continuity of eruption in all other parts of the maxillae.

Fig. 2.—Occlusal view.

Anderson[1] objects to the use of the word submerged in reference to these teeth in that it gives the impression that they are sinking from sight. It is his assertion, based on histologic evidence presented by Aisenberg, of the University of Maryland, that for one or more reasons, bone penetrates the root of the deciduous tooth and ties this tooth to the bony region so affected, an ankylosis of the tooth to the contiguous bony tissue resulting.

Kronfeld[2] also mentions this condi-

tion, saying that the occurrence of impaction or submergence of deciduous molars can also be explained by resorption and subsequent ankylosis with the alveolar bone. Such teeth have ceased to move occlusally and remain below the occlusal level of the other teeth. He states that if such bony ankylosis of a deciduous tooth develops to a great extent, it may even make normal exfoliation of the deciduous tooth and eruption of the permanent successor impossible. For this reason, it is advisable to remove deciduous teeth that are submerged, or, rather, left behind, in the process of dental and alveolar growth. However, there is no definite reason to believe that the removal of deciduous teeth of this nature is a guarantee that normal vertical growth will surely ensue in the areas in question and that the succedaneous tooth or teeth will erupt

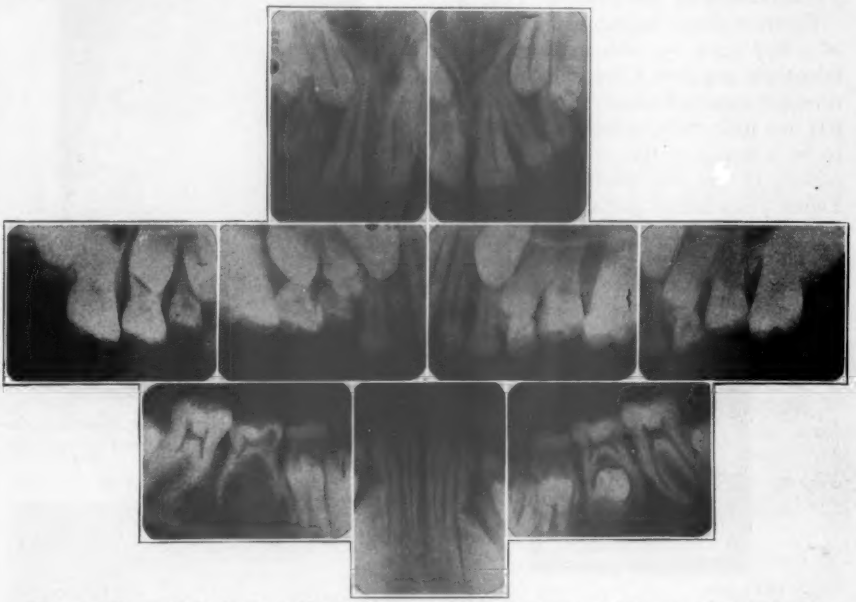
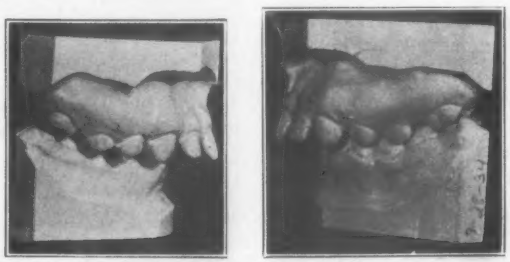


Fig. 3.—Congenital absence of upper left lateral incisor, upper right second premolar and lower left second premolar. The deciduous molars are below the level of the occlusal plane.



A B

Fig. 4.—Lack of vertical growth in molar and premolar areas. A, right view. B, left view.

in normal position. Since vertical growth can be arrested or stopped completely in a deciduous dental area, it seems logical that such a contingency arises in the permanent dentition. We are all familiar with the generalized lack of vertical growth that is frequently a concomitant of distoclusion. (Fig. 4.)

Figure 5 shows the models of the jaws of a boy aged 13, with medical history essentially negative. Clinical examination revealed apparent extraction of the upper left first molar. On probing what seemed to be a fistula in this area, the occlusal surface of the first molar was reached. Figure 7 is a lateral jaw x-ray film of the left side. The first molar is shown to be impacted. The tooth also shows a metallic filling in place. This does not show so well in the cut as in the original

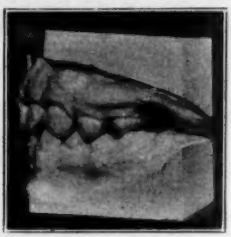


Fig. 5.—The upper left first molar is apparently missing.

x-ray film, but the fact was verified on subsequent extraction and examination of the tooth. This is definite evidence that this tooth was a functioning member of the dentition and that a localized arrest of vertical growth occurred in this area. The premolars and the second molar, erupting subsequently beyond the limits arrived at by the first molar, inclined from their normal vertical positions. The premolars shifted far enough distally and the second molar mesially, to cause an impaction of the submerged first molar.

It is evident, therefore, that disturbance of vertical growth is frequently present as a general condition in both the deciduous and the permanent dentition. A localized disturbance of vertical growth is also met with in either the permanent or the deciduous dentition, and this condition may simulate a tooth

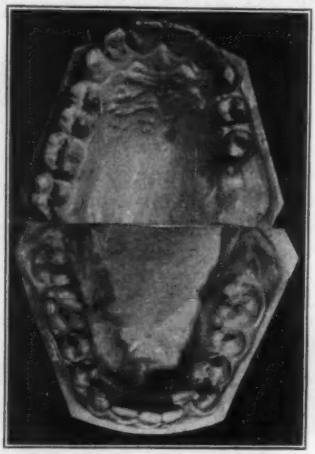


Fig. 6.—Occlusal view. The depression in the upper left molar area seemed to indicate that a tooth had been extracted.

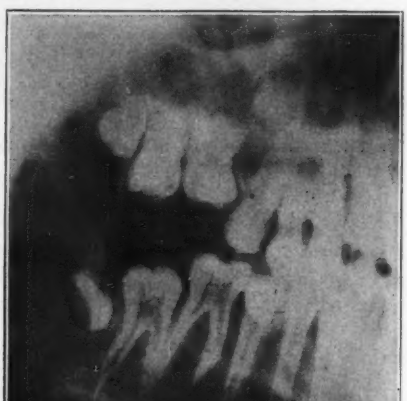


Fig. 7.—Impacted upper left first molar, with evidence of metallic occlusal filling.

that is submerged. Such a tooth will frequently become impacted.

BIBLIOGRAPHY

1. ANDERSON, G. M.: *New York J. Dent.*, 10:215, May 1940.
2. KRONFELD, RUDOLF: Histopathology of Teeth and Surrounding Structures. Ed. 2. Philadelphia: Lea & Febiger, 1939, pp. 232-234.

119 West Fifty-Seventh Street.

THE PHILOSOPHY OF NUTRITION AS RELATED TO DENTAL DISORDERS

By MORRIS L. DRAZIN, M.D., Jackson Heights, L. I., N. Y.

THE regulations of the Selective Service of the United States Army provide that a registrant, in order to be accepted for service, must have a minimum of six masticating teeth and six incisor teeth, all of which must be so opposed as to serve the purposes of incision and mastication.[1] This reasonable requirement has not been met by a large number of men examined. In New York City, of the rejections based on physical defects, 11.37 per cent were due to dental conditions.[2] This figure does not take into consideration the number of men with dental caries, a number of men accepted having remediable dental defects. However, to date, no tabulation has been made of the total dental defects among the examinees. As it is, we are faced with a situation in which one man out of every eight is unacceptable for army service because of the condition of his teeth. Since these men are supposed to represent the flower of our manhood, the inference that among other population groups dental defects are even more common is justifiable. Such a state of affairs constitutes a serious public health problem and one which requires the earnest attention of the medical and dental professions. The military authorities reject men who do not meet the minimum dental requirements, because they do not consider such men well enough to stand the strain of army life, which invigorates the fit and healthy, but may injure the unfit. Loss of teeth prevents proper mastication of food, which, in turn, interferes with digestion and the nutrition of the organism. Such men cannot be considered healthy, and the military authorities are wise in excluding them from the army. It is clear, therefore, that dental disorders present an important problem from the standpoint of national defense.

The question of dental decay has engaged the attention of the dental and related professions for a long time. Thus far, no definite answer has been given. Of the numerous theories of the causation of dental caries, I shall mention the following: (1) the acid reaction of the saliva; (2) the bacterial flora of the mouth, and (3) deficient nutrition.

ACID REACTION OF SALIVA

Hubbell[3] studied the blood and saliva of thirty-two children from 9 to 16 years old, fifteen of whom were free from caries and seventeen caries susceptible. She found that while in caries-free children, the average salivary alkalinity was 24 per cent higher than in the caries-susceptible group, there was too wide a range within the group, and in-

Read before the dental staff of Queen's General Hospital, Jamaica, N. Y., April 17, 1941.

dividual variations were too great for definite conclusions as to the influence of the reaction of saliva in the production of dental caries.

BACTERIAL FLORA OF MOUTH

Lactobacillus acidophilus has been considered by certain investigators a cause of dental caries. Hadley and Bunting[4] found an average of 60,000 *Lactobacillus acidophilus* organisms per cubic centimeter of saliva in fourteen caries-susceptible children as compared with an average of 600 per cubic centimeter in ten caries-immune children. Injection intradermally of vaccine prepared by Jay, Crowley and Bunting[5] from forty oral strains of *Lactobacillus acidophilus,* into caries-susceptible persons, was attended by a cutaneous reaction in nearly all cases. Negative reactions were obtained in the caries-free. These authors attributed this phenomenon to a sensitization of the organism to *Lactobacillus acidophilus.* Bunting and his associates[6] believe that in the caries free, an agglutinin for *Lactobacillus acidophilus* is present in the blood stream which prevents the implantation of the organism in the mouth. They also state that strong sugar solutions in the mouth promote the growth of *Lactobacillus acidophilus,* with consequent acid formation. Whether strong sugar solutions as such will decalcify enamel is not certain, but eating hard candies containing citric acid seems to have that effect.[7] However, May Mellanby,[8] working with dogs, was unable to produce dental caries in the presence of *Lactobacillus acidophilus,* even when glucose in large amounts was included in the diet. Also, Boyd, Zentmire and Drain[9] maintain that the nature of the oral ora and their ability to produce acid cannot be correlated with the incidence of dental caries. They found that *Lactobacillus acidophilus* and other acid-producing organisms may exist in mouths persistently free from dental caries, provided the diet is adequate.

DEFICIENT NUTRITION

Mellanby[8] established that improper feeding of the mother dog will result in poor tooth structure in the pups. If puppies on an insufficient diet are given a good diet, the teeth respond by improved calcification of the enamel and dentin. Wolbach and Howe[10] showed that the teeth in rats and guinea-pigs are profoundly affected by a vitamin A deficiency. The ameloblasts respond by atrophy, which is followed by metaplasia, calcification and ossification. The enamel changes are succeeded by atrophy of the odontoblasts, resulting in deformities of teeth due to deficient dentin formation. Wolbach[11, 12] states that, in vitamin C deficiency, there is resorption of the intercellular substance of the tissues, resulting in endothelial weakness, with consequent bleeding. The lack of collagenous material in the bones causes hemorrhage due to mechanical weakness. In hemorrhage from the gums, there is resorption of the alveolar processes, with consequent loosening of the teeth. In growing teeth of guinea-pigs, formation of dentin ceases and the pulp becomes separated from the dentin by a liquid, possibly produced by the action of the odontoblasts. Teeth in the process of formation in infants may be similarly affected. All calcification processes in the body are dependent on a normal concentration of calcium and phosphorus ions in the blood. Since, in a deficiency of vitamin D, the calcium and phosphorus in the blood are low, the enamel and dentin will become hypoplastic.[7]

Clinical investigations by numerous investigators on growing children appear to support the results of animal experiments. Hanke[13] reports the arrest of 50 per cent of caries in children by the administration of a pint of orange and lemon juice daily to each child in ad-

dition to a sufficient diet. On this régime, gingivitis cleared up. This food supplement provided not only ample supplies of ascorbic acid, but also other nutrients, contained in the citrus fruit juices. He advocates the following diet:

8 ounces of milk for adults, 32 ounces for children.

1 egg for adults, 2 eggs for adolescent children and pregnant women.

One-fourth to one-half head of lettuce.

One-half pound of fruit daily.

Four-fifths pound of vegetables.

Meat once daily.

1 pint of orange juice plus the juice of 1 lemon.

McBeath and Zucker,[14] in an investigation on 800 children over a period of four years, found that the incidence of dental caries is apparently influenced by vitamin D, being lowest in the summer. Irradiation with ultraviolet light led to reduction of dental caries. A similar result was obtained when vitamin D milk was given.

Koehne and Bunting,[15] in a study of 169 children in an orphanage who were kept on a simple, but fairly ample diet devoid of sugar and candy, found that only seven had dental caries over a period of one year. Then for five months each of fifty-one children received 3 pounds of candy weekly, which was consumed in addition to the regular diet and, during this period, *Lactobacillus acidophilus* increased markedly in the mouths of 80 per cent of the children. At the end of this period, 44 per cent showed active dental caries. This would appear to incriminate sugar and candy as a cause of caries.

McCollum[7] states that a high fat, low carbohydrate diet such as is used in control of diabetes reduces the incidence of dental caries. He suggests that there is a possibility that oil or fat acts as a protective coating for the enamel, preventing erosion by acids due to fermentation of carbohydrates.

The incidence of dental caries in relation to the dietary habits of man is of interest. Where industry and transportation are primitive, the people are forced to live upon the food products which they can obtain locally by farming, keeping flocks, hunting or fishing. The ancient Egyptians seem to have suffered from dental caries.[16] The early American colonists, according to Weld,[17] who wrote his book in 1795, had decayed teeth at an early age. Since the consumption of sugar in those days was low, sugar could not have been the cause of dental caries. This appears to be borne out by the excellent teeth of the primitive people of the Fiji Islands.[7] Their tooth structure was good and there was little tooth decay, in spite of the fact that they consumed considerable amounts of cooked starches capable of fermentation to acid and partook of large quantities of sugar cane. However, their diet abounded in tropical fruits and a large variety of vegetables. Sea food was consumed in quantities. The tropical sun supplied vitamin D to their naked bodies. Under these conditions, their general health and dentition remained good. Under widely different conditions of climate and diet, the Eskimos manage to maintain their health and have great physical endurance. Their teeth are preserved to old age and there is little tooth decay. Their diet is largely carnivorous, but is rich in vitamins and minerals. They eat the internal organs of animals, which are richest in vitamins. Raw fish and meat are usual articles of diet. Their food is largely unadulterated, and they manage to cope with the rigorous conditions under which they exist. The early American Indians had teeth free from caries, and their health and endurance were good.[7]

Price[18] brings forward evidence that the maintenance of good dentition has no relation to race, climate or oral hygiene. He found that people in various parts of the globe and belonging to

all races, such as the whites of isolated cantons of Switzerland and of the Hebrides Islands off the coast of Scotland, Indians, Eskimos, Negroes and Polynesians all maintain good health and have good teeth as long as they subsist on the type of natural foodstuffs which has been used in their locality for generations. When, under the impact of civilization, they eat refined, modernized foods, which frequently are devoid of vitamins and minerals, their once perfect teeth begin to decay. Furthermore, Price calls attention to the fact that physical degeneration sets in, characterized in part by a narrowing and deformity of the dental arches, dental caries and general impairment of health. A similar opinion is held by Dorsey,[19] who states:

> Our teeth are on the go. A perfect civilized set is rare. In hundreds of skulls I collected in New Guinea, there was not one imperfect set—all strong, sound, beautifully aligned.

The rôle that nutrition plays in dental health and disease can perhaps be better appreciated by brief consideration of certain facts relating to the development and structure of the teeth.[7] The tooth has a layer of enamel capping it to the gum margin. The body, neck and roots of the tooth are composed of dentin covered by cementum. Within the dentin, there is a pulp cavity which contains nerves, blood vessels, lymph vessels and connective tissue. The inorganic constituents of the tooth consist of a mixture of calcium carbonate and calcium phosphate, with traces of magnesium and fluorine. The dentin contains a larger amount of organic material than the enamel, which is generated from the ectoderm by specialized cells called ameloblasts. Enamel is laid down from within outward. Like all epithelium, enamel is especially sensitive to vitamin A deficiency. The enamel forms from four ossification centers, which unite to form the enamel crown of the tooth. Interference with the union of these ossifying columns will result in pits or crevices, where the accumulation of food débris may lead to fermentation and tooth decay. Enamel is laid down in hexagonal prisms, which should fit perfectly. If the ossification is interfered with, they do not fit well and the result is a pitting of the enamel. This condition is to be differentiated from mottling of enamel, which is thought to be due to a high fluorine content in drinking water.[20] The dentin is derived from mesoderm. The cells which lay down dentin—the odontoblasts—work from without inward, so that the pulp cavity gets smaller as the tooth nears maturity. Like all connective tissue structures, the dentin is especially sensitive to vitamin C deficiency.[12] Since both the enamel and the dentin are calcified structures, anything that interferes with calcification, such as lack of vitamin D, calcium or phosphorus, will also result in improper enamel or dentin formation. Within the dentin, there are fine canals extending from the pulp cavity, where minute lymph vessels are present. In other words, the tooth is a living structure in intimate connection with the rest of the body through a system of nerves and blood vessels. The very minuteness of the nerves and circulatory channels within the tooth makes the tooth vulnerable to deficiencies within the fluid matrix that reaches the tooth. If this is poor in nutrients, the tooth will not get sufficient material to keep it in a proper state of health, and tooth decay will ensue.

The teeth, therefore, are closely associated with the metabolic processes, which, in the last analysis, are designed to supply the body with energy. This energy, however, must come from food. The conversion of food into energy is not a simple process. If we place a piece of beefsteak in a container of oxygen, no liberation of energy takes place. Something must be done to initiate the union between the beefsteak and the oxygen. One of the means of starting the chem-

ical union is heat. If the container in which the beefsteak and oxygen are present is heated, chemical changes will ensue, and if the temperature rises still further, the ultimate result will be carbon dioxide, some other gases, water and minerals. Within our organism, the conversion of foodstuffs into carbon dioxide and water takes place at the temperature of the body, which is not high enough for the chemical reactions mentioned earlier.

In the body, therefore, a different mechanism exists. The liberation of energy takes place piecemeal through a stepwise system of oxidation and reduction reactions. Thus, before a molecule of glucose is converted into carbon dioxide and water, twelve pairs of atoms of hydrogen must be abstracted from it.[21] This process takes place through the help of marvelous substances called enzymes, the function of which is to reduce, oxidize and take away a carboxyl radical here or split off a side chain there. The glucose molecule goes through a series of metamorphoses into a large number of simpler compounds prior to its complete oxidation. These intermediary reactions all result in the liberation of some energy, but the products formed may be very toxic, if they accumulate in the body without being used up. Since each step requires a special enzyme, a bottleneck will develop, there will be an accumulation of one intermediary product, and the production of energy along the enzymatic belt line will be disturbed if some enzyme is lacking. When such disturbance occurs, the entire organism is affected, for these processes go on in innumerable cells of the body; but some cells are affected more than others by a deficiency of certain enzymes. These enzymes are produced in the body largely from the various vitamins which are taken in foods. Consequently, a diet that does not provide enough of the vital raw materials for enzyme production will not be able to sustain life. It thus becomes clear why it is possible for a diet to contain enough calories, proteins, carbohydrates and fats and yet be insufficient to sustain life if all vitamins have been removed from it.

We can now understand how a deficient diet must ultimately affect the dental structure. The teeth are, in a sense, the first lines of defense of the organism. They are designed by nature to take and inflict severe punishment. Watch a dog crush a bone. Think of the great amount of energy which is used. This energy must be supplied to the tooth doing the work by the circulation of nutrients through the tooth or the tooth is bound to break down. A healthy tooth thrives on hard work. Chewing hard foods, cracking bones, struggling with a hard piece of fiber, cartilage or ligament provides exercise for the jaws, massages the gum margin and polishes the teeth.[22] Perhaps one reason for the breakdown of modern teeth is our insistence on having soft, mushy, refined foods. Children are reprimanded if they chew bones. Let them do it! It is good for the teeth; and by swallowing some of the ends of the soft bones, they are providing their bodies with an excellent source of calcium and phosphorus. If they crave something sour, satisfy that craving; for if their stomachs do not secrete enough acid, this calcium may not be dissolved and so will pass through the body unutilized.

What constitutes an adequate diet? It is one that will keep the organism in a state of well being and will provide for optimum development, growth and repair. It must be sufficient both quantitatively and qualitatively. The diet must be suited to the individual. A longshoreman cannot live on the same diet as a sedentary clerk. An obese person is better off on 1,200-1,800 calories. The locality may determine the adequacy of the diet. The high fat, high protein diet of the Eskimos would be

unsuitable in the tropics. In general, a diet must be balanced: it must supply enough calories, protein, carbohydrates, fats, minerals and vitamins. The simpler the diet, the better. The less refined the foods are, the more wholesome they are apt to be.[23] However, "Man does not live by bread alone." The mere provision of an apparently adequate diet is not an assurance of satisfactory nutrition. We must take into account personal idiosyncrasy, prejudice, tribal habits, the digestive capacity and the metabolic ability. Furthermore, in studying the problem of dietary adequacy, certain disturbing factors present themselves that our present knowledge does not properly explain. Thus, patients with anorexia nervosa very seldom evidence a clear-cut dietary deficiency despite their great emaciation. The following account of a French officer's escape from a German prison camp is of interest here[24]:

> We suffered from hunger, especially at first, in the camp, where we were assembled in Lorraine. During ten days, we lived on a daily ration of only a cup of coffee and 150 grams (slightly more than 5 ounces) of black bread. In Germany, we received indefinitely potatoes, turnips, cabbage, barley and oats. Once a week we got a link of sausage, once a week a portion of codfish.
>
> According to their temperament, the officers and men suffered more or less. For the big eaters, the gift packages were absolutely necessary. But in general we were surprised to see how small was the minimum food indispensable to keep on living.

In these times of stress, it is amazing to read of the feats of endurance performed by men living on grossly inadequate diets. Furthermore, certain people are more apt to develop symptoms of nutritional deficiency than others on the same diet. Perhaps some persons store more vitamins than others. There is also the possibility that the dietary requirement depends on the morale. By the latter, I mean the ability to muster sufficient courage and fortitude to carry on despite unfavorable odds. Is it not possible that a person of high morale possesses an internal organization which husbands its resources carefully and economically, and which is able to function with much efficiency? Contrast the person of high morale with one torn by fear and anxiety. Is not the latter prodigal of his internal resources and is not his efficiency at a low ebb? Place the two types under similarly distressing conditions pertaining to food and external discomfort and hazard, and the latter is more apt to break down than the former. The explanation may lie in the higher energy requirement of the emotionally disorganized persons, which, if not satisfied by proper cellular nutrition, will bring disaster to the organism.

Trained soldiers and athletes withstand hardships and privations better than raw recruits and novices. Training teaches the person how to organize himself and how to mobilize his internal energies. Hence, in appraising the nutritional status, is it not of value to take into account the emotional integration or morale?

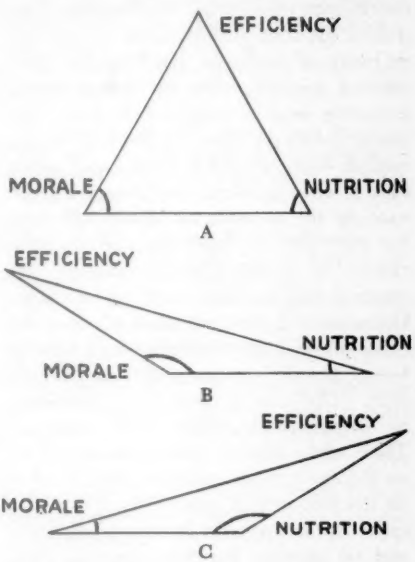
The relationship between nutrition and morale is as fascinating as it is complicated. That nutrition affects the emotions and consequently the morale is well established. Thus, the first concern of a good general is how to feed his troops.[25] There is also clinical evidence that a poor state of nutrition affects unfavorably the emotional organization of a person. I have described a clinical syndrome of chronic illness caused by dietary deficiency.[26] The patients were nervous and irritable; they tired easily and had multiple pains and aches, and they were unable to carry on their daily work. These people were considered neurotic and their lot was pathetic. Investigation showed that they subsisted on a very deficient diet. It was found that this type of chronic illness could be remedied by an ample well-balanced diet. Frostig and Spies[27] describe men-

tal changes caused by vitamin deficiencies. Jollife[28] described a neurasthenic syndrome due to a deficiency of thiamine chloride.

The converse side of the problem, whether the morale affects the nutrition, warrants consideration. The great physiologist Cannon[29] showed that fright and rage affect the organism profoundly. The blood sugar rises, respiration deepens, the blood goes from the intestines to the heart, brain and muscles; the digestion stops, sugar is freed from the liver, the spleen contracts and discharges its content of concentrated corpuscles into the circulation and adrenalin is secreted from the adrenal medulla. This means that the organism mobilized all its energies for a forthcoming struggle. Hence, it is fair to assume that there is a tremendous call for an increase in cellular nutrition, the latter in all probability being enzymatic. What is true of fear and rage is probably true of other emotions. A highly emotional state calls for much energy; and if the organism cannot provide such energy, trouble develops. This aspect of the problem is exceedingly important from a military viewpoint. Hall[30] states that the strict discipline of military life is directed toward control of emotions. He says that cowardice is fear yielded to; bravery and courage are fear controlled. Fear is anticipatory pain, and mortal fear is, of course, the anticipation of death. Where great danger impends, every symptom of fear is met. There is weakness, sometimes rising to paralysis, unsteadiness of movement, loss of appetitie, perhaps nausea, indigestion and diarrhea, flushing and pallor. There is a tendency to cringe and dodge and show symptoms of shock at everything unexpected. Under such conditions, the organism is wasting energy in the face of a need for the utmost that the body is capable of supplying. However, training enables the individual to master fear and minimize the drain on his system. Training and discipline help him to master himself under unfavorable conditions.

Morale and nutrition have a reciprocal relationship and efficiency depends on the proper balance between morale and nutrition. This relationship between nutrition and morale and efficiency can be illustrated by the accompanying diagrams.

Diagram A illustrates that efficiency is probably at the best when high morale and good nutrition coexist. Diagram B illustrates that, in the presence of a high



Relationship of nutrition, morale and efficiency.

morale, the efficiency of the organism may be maintained despite subnormal nutrition. This explains why it is possible for enthusiastic, courageous and devoted men to perform heroic work in the face of great privation. On the other hand, if the morale is low, as illustrated in Diagram C, the nutrition must be very high for the efficiency of the organism to maintain itself; for, in the person of low morale, there is much waste of en-

ergy, and unless this energy loss is replenished from without, symptoms of deterioration set in. This explains why troops of low morale are so greatly demoralized when cut off from supplies.

Perhaps the dental caries widespread among civilized people may not only be an index to poor nutrition, but may also point to a low morale in civilized communities. Civilized man is subject to innumerable frustrations, repressions and disappointments. His emotions do not get free expression. He is constantly hemmed in and is curbed by all sorts of restrictions and tabus. He has lost control of his food supply, and, in the vast majority of cases, he has also lost control of himself. On the other hand, primitive man is exposed to fewer internal conflicts. Most of his time is occupied with securing food, and when that is accomplished, he is well on the road to the enjoyment of life. Because his very life is dependent on his efficiency as a functioning machine, his internal organization must be excellent. Consequenty, the so-called savages are much more highly integrated persons as far as morale is concerned than civilized man. They are trained from childhood to withstand hardship and privation. Their endurance is phenomenal. Thus, an Eskimo can sit poised for many hours on his toes near a hole in the ice with a spear in his upraised hand waiting for a seal to appear. He does not eat, drink or move a muscle during this vigil.[31] The Bushmen of the Kalahari desert of Africa will chase the antelope on foot and secure it only after both man and beast are exhausted.[7] The skill and endurance of the Australian Aborigines are, according to Price,[18] astounding. He describes the training of their young as follows:

> Every boy and girl among these Aborigines must pass many examinations. Their early schooling includes the tracking of small animals and insects. The small boys begin throwing spears almost as soon as they can stand up straight. No young man can even witness a meeting of the council, let alone become a member of it, until he has passed three supreme tests of manhood. First, he is tested for his ability to withstand hunger without complaint. The test for this is to go on a march for two or three days over the hot desert and assist in preparing the meals of roast kangaroo and other choice foods and not partake of any himself. He must not complain. If he becomes too weak, he is given a small portion. There are tests for fear in which he is placed under the most trying ordeals without knowing that it is part of his examination, and he must demonstrate that he will accept death rather than flee. No member of their society would be allowed to continue to live with the tribe if he had defied the ideals of the group. Immorality is cause of immediate death.

This high morale and discipline may perhaps account for their excellent metabolism which, added to their consumption of unadulterated foodstuffs, results in good general and dental health.

Of course, in civilized communities, not only the strong, but also the weak are enabled to survive. It is the task of the medical and dental professions to restore the latter to the fullest possible efficiency. The dentist has before him a tremendous problem. Curative and restorative dentistry can keep every dentist in the United States busy for many years. But another and more engrossing opportunity lies before the dental practitioner: He must consider himself a physician specializing in diseases of the oral cavity. He must regard the individual as a whole. As he determines the dental status, he must also note the state of the gums, the tongue, the lips and perhaps the conjunctivae. A glance at the corners of the mouth may show fissures and cracks due to riboflavin deficiency. The tongue may show the pale smoothness of pernicious anemia, the sloughlike glossitis of pellagra or the angry magenta red of riboflavin deficiency. Vincent's stomatitis may be due to a nicotinic acid deficiency. The very

presence of dental caries should put the dentist on the alert lest the patient's diet be deficient. If such a patient in undergoing dental treatment shows unusual signs of fear, anxiety and distress and an abnormal sensitivity to pain, the dentist should suspect that this patient is in double jeopardy; first, because of inadequate nutrition, and, secondly, because his heightened emotional state makes him more vulnerable to this deficiency.

BIBLIOGRAPHY

1. Selective Service Regulations, Vol. 6. Physical Standards.

2. KOPETZKY, S. J., and TIBER, A. M.: Statistical Report of Medical Findings for First, Second, and Third Induction Periods in N. Y. C. Area up to and Including January 31, 1941. N.Y.C. Selective Service Administration.

3. HUBBELL, R. B.: Chemical Composition of Saliva and Blood Serum of Children in Relation to Dental Caries. *Am. J. Physiol.*, 105:436, August 1933.

4. HADLEY, FAITH P., and BUNTING, R. W.: Further Studies on Recognition of B. Acidophilus. J.A.D.A., 19:28, January 1932.

5. JAY, PHILIP; CROWLEY, MARY C., and BUNTING, R. W.: Preliminary Studies on Immunology of Dental Caries. J.A.D.A., 19: 265, February 1932.

6. JAY, PHILIP, et al.: Bacteriologic and Immunologic Studies on Dental Caries. J.A.D.A., 20:2130, December 1933.

7. MCCOLLUM, E. V.; ORENT-KEILES, ELSA, and DAY, H. G.: Newer Knowledge of Nutrition. Ed. 5. Philadelphia: Macmillan Company, 1939.

8. MELLANBY, MAY: Diet and Teeth; Experimental Study. Medical Research Council Special Report Series No. 140, 191. London.

9. BOYD, J. D.; ZENTMIRE, ZELMA, and DRAIN, C. R.: Bacteriologic Studies in Dental Caries. *J. D. Res.*, 13:443, December 1933.

10. WOLBACH, S. B., and HOWE, P. R.: Incisor Teeth of Albino Rats and Guinea Pigs in Vitamin A Deficiency and Repair. *Am. J. Pathol.*, 9:3, May 1933.

11. WOLBACH, S. B.: Pathologic Changes Resulting from Vitamin Deficiency. *J.A.M.A.*, 108:7-13, January 2, 1937.

12. *Idem:* Controlled Formation of Collagen and Reticulum. *Am. J. Path.*, 9, supplement, 1933.

13. HANKE, M. T.: Diet and Dental Health. University of Chicago Press, 1933.

14. MCBEATH, E. C., and ZUCKER, T. F.: Role of Vitamin D in Control of Dental Caries in Children. *J. Nutrition*, 15:547, June 1938.

15. KOEHNE, MARTHA, and BUNTING, R. W.: Studies in Control of Dental Caries. *J. Nutrition*, 7:657, June 1934.

16. RUFFER, M. A.: Studies in Paleopathology of Egypt. University of Chicago Press, 1921.

17. WELD: Manners and Customs in Philadelphia, 1795. Quoted by McCollum, Reference 7.

18. PRICE, W. A.: Nutrition and Physical Degeneration. New York: Paul B. Hoeber, Inc., 1939.

19. DORSEY, G. A.: Why We Behave Like Human Beings. New York: Harper & Bros., 1925.

20. SMITH, M. C.: Iodine and Fluorine. Food and Life. Year Book of Agriculture. Washington: U. S. Government Printing Office, 1939.

21. COLOWICK, S.; CALKAR, H. M., and CORI, C. F.: Glucose Phosphorylation and Oxidation in Cell Free Tissue Extract. *J. Biol. Chem.*, 137:1, January 1941.

22. PELZER, R. N.: Study of Local Oral Effect of Diet on Periodontal Tissues and Gingival Capillary Structures. J.A.D.A., 27: 13, January 1940.

23. DRAZIN, M. L.: Nutrition and National Defense. *Mil. Surgeon*, 88:1, January 1941.

24. *New York Times*, April 13, 1941.

25. ZINDER, HARRY: Wavel. *Life Mag.*, 10:9, March 3, 1941.

26. DRAZIN, M. L.: Chronic Illness Due to Dietary Deficiency. *New York State J. Med.*, 35:21, November 1935.

27. FROSTIG, J. P., and SPIES, T. D.: Initial Nervous Syndrome of Pellagra and Associated Deficiency Diseases. *Am. J. Med. Sc.*, 199:268, February 1940.

28. JOLLIFE, NORMAN: Newer Knowledge of Vitamin B Complex. *Bull. New York Acad. Med.*, Second Series, 17:3, March 1941.

29. CANNON, W. B.: Wisdom of the Body. New York: W. W. Norton & Co., Inc., 1932.

30. HALL, G. S.: Morale. New York: D. Appleton & Co., 1920.

31. DE PONCINS, G., and GALANTIERE, L.: Kabloona. New York: Reynal & Hitchcock, 1941.

PREVENTION IN THE PRACTICE OF OPERATIVE DENTISTRY

By Robert E. Blackwell,* D.D.S., M.S., Chicago, Ill.

In defining operative dentistry, G. V. Black[1] included "... those operations upon the natural teeth and soft parts immediately connected with them for the repair of damage inflicted by caries, and the treatment of diseases resulting from the exposure or death of the pulps of the teeth ... [and] that group of diseases of the peridental membrane beginning at the gingival border." His definition was generally accepted and still is considered by many dentists, especially teachers, accurately to designate the field. To me, while certainly broad in its scope, it is not entirely satisfactory because it does not suggest the opportunities for prevention which operative dentistry affords. In rewriting his father's books, Arthur D. Black[2] made this statement: "Operative Dentistry, in the author's conception, consists of all procedures, including preventive measures, by which the teeth may be conserved, and thus maintain the masticating mechanism in such a state that the general health will not be endangered." That is to say, operative dentistry and preventive dentistry are one and inseparable until such time as science may have determined all the causes of dental disease, immediate and predisposing, together with all the means of prevention; until the public has also come to understand these causes and through education and training, or possibly in submission to governmental fiat, has put into use the means of absolute prevention. Such a millennium is not of our day and generation. We can study and train ourselves, we can educate the public in the newer knowledge of prevention in so far as we understand it, but if our patients are to be free from the menace of focal infection of dental origin, it will be necessary for us who are in general practice to follow a definite plan of procedure designed to conserve the teeth of our patients in health, function and comfort from early childhood to adult life and beyond, or until unavoidable degenerative processes over which we have little or no control bring about the loss of the natural dentures.

W. D. Miller,[3] G. V. Black[2] and J. Leon Williams[4] during the nineteenth century gave to the dental profession the fundamental basis of the pathology of dental caries. It is, of course, well known that Miller was largely responsible for what is now called the chemicoparasitic theory of dental caries. His work was followed by that of Black and Williams on the gelatinoid plaque, which in turn enabled Black to map the areas of liability on the several surfaces of the teeth and bring into practical use the principle of extension for prevention—a practice which in our time appears to have been universally adopted.

During the last twenty-five years, a tremendous amount of research has been under way in this country and abroad, having as its aim the discovery of the obscure or mysterious causes of caries.

*Professor of operative dentistry, Northwestern University Dental School.

Read before the Section on Operative Dentistry at the Seventy-Seventh Annual Midwinter Meeting of the Chicago Dental Society, February 20, 1941.

Much of this work has been done by groups of scientists in laboratories equipped with every modern device for the study of the dental tissues and the chemistry and bacteriology of the saliva. These workers have had the advantage of observing in clinics patients who presented all degrees of susceptibility to caries as well as a few persons absolutely immune to caries; of studying controlled groups in institutions and of experimenting extensively on animals. The result of these studies, as recently summarized in "Dental Caries,"[5] a book published by the Research Commission of the American Dental Association, is a mass of evidence—much of it conflicting—which leaves the student confused, if not quite bewildered.

Probably most of us are convinced that the solution of the problem is to be found in the field of diet and nutrition, and many of the recent studies have been along this line. Certainly diets for the maintenance of bodily health and well-being have been improved, but, in so far as the prevention of caries is concerned, it seems safe to say that no dietary theory has been advanced which meets with general acceptance or which, at least, is not considered a subject for debate. In the analysis of the 195 summaries contained in the report of the research commission, there is this significant statement:

> Opinions are divided as to whether caries is due to dietary deficiency of any nutritional essential. There is little dissent from the prevailing judgment that a balanced diet—containing optimal amounts of all essentials for the production of perfect teeth—does not assure immunity from caries if local (oral) conditions are favorable for the multiplication and destructive action, on dental areas, of acidogenic oral bacteria.

It is claimed that an excess of sugar in the diet is largely, if not entirely, responsible for caries. There is nothing new in this. As far back as I can remember, I was told that eating candy would cause my teeth to decay. Magitot,[6] in 1867, placed sugar in all its forms first on the list of "injurious alimentary substances" in this respect. He said, "We have seen how powerful this agent of alteration is in the mouth and we are convinced that it should be held responsible for very many of the frequent cases of caries of the temporary teeth of children who are allowed the immoderate and almost constant use of this substance."

More recently, investigators have established the fact that sugar is a very important contributing factor in dental caries[7, 8]; that while its elimination from the diet is not effective in all cases, the majority of caries-susceptible cases are benefited when the eating of sugar is drastically limited. In this country, where the annual per capita consumption of sugar is approximately 110 pounds, have we any reason to expect any general reduction in the incidence of caries during our day and generation?

There are those who contend that sugar is not a strong contributing factor in caries activity.[9, 10] To be sure, it has not been effective in producing caries in the teeth of experimental animals. Also, it is apparent that some people are so perfectly immune that large quantities of carbohydrate in the diet are not harmful to the teeth. But there is an ever-increasing mass of evidence that a drastic reduction in the amount of carbohydrate in the diet of the average person susceptible to caries is capable of reducing caries activity.

Great reduction in susceptibility to caries has been anticipated from the addition of one or more of the several vitamins to the diet. As yet, the results reported are somewhat contradictory. It is doubtful, at least, that this dietary change will have favorable results.

I have mentioned only two avenues of investigation, to recall the general trend which investigations have taken and to emphasize the apparent hopelessness of any immediate improvement in oral con-

ditions by means of the dietary. It seems very likely that, in this country, the diets of the people, at least in the middle and upper socio-economic groups, have been greatly improved during the last thirty years. That these people are interested in what they hear about vitamins is attested by the fact that, in 1938, more than $100,000,000 was expended for vitamin concentrates.[11] The consumption of milk in these groups appears to be adequate.

Thomas Parran, Surgeon General, U. S. Public Health Service, in an article in *Parent's Magazine* for January 1941, has called attention to the gains in general health made by children and young people during the last generation. He confirms an observation made by many of us in recent years that the children of this generation are taller, heavier and healthier than those of the previous generation. And yet you and I know that caries is rampant.

Within the year, I heard C. E. Rudolph, of Minneapolis, in an informal statement, say that P. J. Brekhus and the members of the student health service at the University of Minnesota had discovered during the last decade that while the average entering student was now taller, heavier and healthier than he was ten years ago, the incidence of dental decay had increased 5 per cent.

It is not my purpose to disparage any of the work that has been done in caries research or to criticize any of the investigators who have been at work. On the contrary, I believe with all of you that much is being accomplished and that, as further investigations are carried on, we should explore thoroughly every avenue of approach. But until we know much more about the causes of caries, and until we are able to prevent its onset, it will still be necessary for the operative dentist to carry the heaviest responsibility in the control of this disease. There is an old saying, accredited to Cromwell, "Trust in God, but keep your powder dry." This might be paraphrased to read: Trust in diet, but keep your chisels sharp.

Our earlier investigators—Miller, Black and Williams—gave to the dental profession an excellent working knowledge of the immediate causes of dental caries. The pathology of caries was well worked out for us. In the conservation of teeth and health, it is still necessary for us to rely on the knowledge gained from their studies.

An adequate program of tooth conservation should begin with the small child. The first visits should begin at 3 years of age or earlier. There should be little for the dentist to do for the child at this age. Getting acquainted and gaining the confidence of the child are the important considerations. Education of the parents to the necessity for early care and frequent periodic visits under a definite recall system is of primary importance. Detailed instruction in the care of the mouth should be given at this time, with every effort to enlist the interest and cooperation of both the child and parents in the maintenance of a clean, healthy mouth.

Dental caries is rather rare at this early age, although cavities may appear at 2 or 2½ years. This is evidence of extreme susceptibility. Such pits or fissures as may need attention during this early period usually should be filled with cement, preferably with copper cement, which does not require the same detail in cavity preparation as other materials; inasmuch as the operation must be done quickly. Proximal decay usually occurs somewhat later and is more difficult to manage. The treatment of such decay in the deciduous molars requires the maintenance of the proximal contact in order that the full mesiodistal space for the succeeding bicuspid shall not be lost. If this decay is discovered early, before the dentin has become involved, treatment by disking away the enamel in order to widen the lingual embrasures is indi-

cated. When this method is followed, contact may frequently be maintained buccally from the affected area. Cut surfaces should be well polished and afterwards treated with silver nitrate. If the extent of caries, either in breadth or in depth, precludes such treatment, amalgam fillings restoring the full proximal contour should be made. It seems necessary to call attention to the fact that children are good chewers and that when amalgam is used in proximal cavities in the deciduous molars, ample resistance and retention form must be provided or the restoration cannot be expected to endure even throughout the life of the deciduous tooth.

Proximal cavities in the anterior teeth may receive somewhat different treatment. There need be no effort to maintain proximal contact, as the incisors are soon separated by the growth of the maxillary bones. Superficial decay may be disked off without much consideration for proximal contact, and if shallow decay remains in the dentin, it may be treated with silver nitrate. Deeper decay calls for excavation and filling with cement, preferably the modified silicate cements. At all times, it should be the aim of the dentist who is practicing conservation to treat all decay at its inception, before any considerable penetration of the dentin has occurred. Pulp chambers in the deciduous teeth are usually large in proportion to the size of the teeth, and pulps may be unexpectedly exposed during the preparation of deeper cavities.

Superficial gingival third decay in the deciduous molars, while yet in the stage commonly referred to as etching, may be treated with silver nitrate. This treatment is comparatively simple and, if repeated at frequent intervals, say of three months, is very effective in arresting the carious process. The ugly stain produced by the silver precipitate almost precludes its use in anterior teeth. Therefore, such etching as cannot be removed by grinding and polishing should be excavated and the cavities filled with cements. The labial and buccal surfaces of all the teeth are so exposed that it is generally possible to prevent caries by proper brushing. Furthermore, failure to brush the teeth regularly and thoroughly will frequently result in severe injury to the teeth of children who are highly susceptible to caries. R. M. Stephan[12] and L. S. Fosdick,[13] working independently and by different methods, have shown that the production of acid takes place very rapidly after the consumption of sugar. Brushing the teeth twice a day, or even brushing them an hour after each meal, probably does little in prevention of caries. If it is to be beneficial, this method of prophylaxis must be employed immediately after eating. Twenty minutes or half an hour after eating is too late. The damage has already been done. Caries on exposed surfaces can be prevented and no pains should be spared in an attempt to prevent it.

Beginning with about the sixth year, our problem becomes more complex and frequently more difficult. As soon as the first permanent molars erupt, the condition of their pits and fissures should be determined. There is considerable difference of opinion with respect to the methods of treatment to be followed in case the developmental lines are faulty. Some dentists would treat all pits and fissures with silver nitrate. Others would fill them with copper cement without cavity preparation. Still others would grind out these imperfections in an attempt to immunize the areas. Perhaps any one of these methods will succeed some of the time. But this is an extremely critical time in our conservation program, and success depends on doing the right thing at the right time. In my opinion, the only sure way to arrest caries is to excavate to the bottom of the fissures. Then fillings are necessary. For the copper cement filling, the preparation need not be very elaborate, but the

filling needs to be replaced frequently. For the modified silicate cement, more detail must be given to cavity preparation, particularly with respect to the enamel margins, in order to guard against fracture of the friable material at this point. When well placed, these fillings will serve for years. Both materials can be used satisfactorily without a rubber dam, as the cavity can be kept dry during the necessary three minutes by means of cotton rolls and napkins.

If permanent restorations are to be employed in occlusal cavities in the permanent teeth of children, gold foil—in the hands of a good operator—is without doubt the best material with which to hermetically seal the cavities. The higher the degree of susceptibility, the greater the need for perfect adaptation of the filling to the walls of the cavity. The possible injury to the gingivae in applying the rubber dam and the strain on the child during the operation must be given serious consideration. Frequently, the operation must be deferred until the patient has matured considerably. Then, too, when there is a personal and family history of strong susceptibility to caries, proximal decay is apt to occur later in the same teeth; which makes it necessary to remove the gold fillings previously placed in order that satisfactory proximoclusal restorations may be made. This proves to be expensive for the patient and, incidentally, embarrassing for the dentist. Therefore, restorations of gold, either gold foil or gold inlay, may have to give way to restorations with some other material. Amalgam has proved to be an excellent substitute.

The proximal surfaces of the upper incisors and cuspids should be treated with silver nitrate after the plan of J. M. Prime,[14] as soon as they have erupted and come into proximal contact. The same treatment should be applied also to the bicuspids and molars. Since the application is more difficult in this region and the proximal surfaces are broader, comparable results should not be expected. In cases of diastema, silver nitrate need not be used, since the proximal surfaces are safe without it. As soon as a second deciduous molar is lost, the mesial surface of the first permanent molar, even if not actually carious, should be treated with silver nitrate as a preventive measure. Slight etching should be treated in the same manner, in an attempt to arrest the carious process. This treatment may fail, but caries will usually be retarded and the day of cavity preparation be postponed until conditions are more favorable for satisfactory restorations. It should be the rule that whenever a proximal surface of a bicuspid or molar is exposed during the preparation of a cavity in the proximal tooth, that surface should be treated with the silver nitrate solution. If, however, caries has progressed to the point of the loss of contour, restoration is indicated. It is not sufficient to treat these surfaces with silver nitrate once and then forget them. The treatment should be repeated every three to six months and the conditions carefully checked from time to time by clinical examination with sharp, curved exploring tines and by bitewing roentgenograms.

At about the twelfth year, all of the permanent teeth should be in position with the exception of the third molars. It may be that no proximal restorations of the permanent teeth have been necessary up to this time. In my experience, that is not unusual. There may appear to be a period of immunity, but this is apt to be apparent rather than real. Caries, particularly proximal caries, may be quite a slow process. Between its very beginning and the time of its earliest discovery by any practical means known to us, two or three years may elapse. Also, if the teeth are well formed and in good occlusion and the gingivae are well up on the neck of the teeth and firm, filling the interproximal spaces, the conditions may be unfavorable for action of the causes

of caries; that is, the local conditions may be unfavorable, while the mouth flora, the condition of the saliva and the general systemic conditions may be favorable for action of the causes of caries. This combination is deceptive, and I believe that this fact was responsible for some disagreement between the results of caries activity tests of the saliva and clinical estimates of susceptibility during recent investigations by the Northwestern University caries research group.[15]

It must not be assumed that, because of appearances, proximal decays will not develop. Early adolescence is one of the most critical periods with which we have to deal. All of us,-and our patients and their parents, have been shocked many times by the sudden discovery of from six to a dozen proximal cavities in the bicuspids and molars, which apparently have developed overnight. The caries activity test used by the Michigan group (as reported by Hadley[16]) could be used to advantage a little earlier in order to anticipate and possibly prevent this condition. If the child has a high *L. acidophilus* count, carbohydrates, particularly sugar, should be restricted under a well regulated dietary régime until the bacteria count has been satisfactorily reduced. At the present time, such laboratory tests may not be readily available to all, but as some commercial medical laboratories are prepared to make bacteria counts for dentists, this may well become a routine procedure in the near future.

In my experience, the principal difficulty with the adolescent patient is to gain his and his parents' complete cooperation in a dietary program. After all, chidren are children and they are husky and growing and they are hungry and they like sweets. Their parents, relatives and friends shower them with candy. Highly sweetened drinks are everywhere available and are consumed in astonishing quantities. One day the patient and his mother may apparently be convinced that sugar is bad for the teeth and that something is going to be done about it. The next day the lad comes into the office working on an all-day sucker. A few frankly say that they would rather go to the trouble and expense of having their teeth repaired than to forego the pleasure and satisfaction of an unrestricted diet. Be that as it may, with or without cooperation of patient and parent, it is our job to keep these teeth in good condition. This is a time in which to make use of Howe's ammoniacal silver nitrate as a preventive. This is the time to make more thorough clinical examinations than we have ever made before. This is the time to make bitewing roentgenograms.

In a comparative study of the efficiency of the clinical examination—that is, with sharp, curved exploring tines—and of the bitewing roentgenograms and the intra-oral profile roentgenograms, Bodmer[17] has definitely shown that no single method is reliable in diagnosing early proximal caries, but, on the contrary, that if all proximal caries is to be discovered in its incipiency, a combination of all methods must be employed. He has shown that 93 per cent of proximal decay in the upper bicuspid region can be diagnosed by means of a clinical examination. Bitewing roentgenographic examination alone revealed only 79 per cent of the cavities. A combination of these two methods revealed 98.5 per cent of the cavities. Similar results, as far as a combination of the clinical examination with the bite-wing roentgenograms was concerned, were obtained in the upper molar and lower bicuspid regions; but, in the lower molar regions, the efficiency rate fell off and only 76.3 per cent of proximal decay was discovered by a combination of the two methods of examination. It is apparent from a study of Dr. Bodmer's findings that much greater care should be exercised in examination, especially of the lower molar

teeth. Dr. Bodmer, in all probability, made much more thorough examinations, both clinical and roentgenographic, than any of us would in routine procedures.

But it may be argued that these areas will be more easily discovered after they have made more progress and that they will not be overlooked in a later examination. No doubt, this is often true, but there is no way of predicting the rapidity of dental caries once the continuity of the enamel has been lost by decalcification. I have opened into many a tooth when the roentgenogram showed merely a slight "nick" in the enamel, only to find extensive involvement of the dentin. Who of us has not found pulps in jeopardy through our failure to discover caries in examining the roentgenograms? This may be due to a poor picture, to faulty angulation or, more than likely, to insufficient study of the picture with proper light and a suitable hand lens. I doubt whether I am the only one who has had a patient return shortly after a periodic examination complaining of discomfort or giving other evidence of advanced caries. Has it ever happened to you? Reexamine the latest x-ray films or still earlier ones and you find that the caries was of long standing. If sound teeth cannot be preserved, perhaps healthy pulps can be. The surest way of preserving a healthy pulp in a carious tooth is to make a restoration before there has been any appreciable involvement of the dentin. G. V. Black, when he gave us a system of cavity preparation, placed the removal of carious dentin in the fifth position in the order of procedure, in the hope, if not the expectation, that, after completion of the outline, resistance, retention and convenience forms, there would be no caries to be removed. Experience has shown that, under these conditions, and when the operative work is well done, the pulps are safe.

This may raise the question as to what restorative material should be used in proximal cavities during the adolescent period. I believe that is a matter which each dentist must decide for himself. Without going into the primary and secondary requirements for restorative materials, let me say that whatever material is used, it must seal the cavity and restore and maintain proximal contour and contact. Whatever is best in your hands, not mine, is the material of choice. For some, this may be amalgam; for others, gold inlays; for a few others, gold foil; or the choice may be influenced by economic considerations.

The cavities should be prepared with full regard for the rules of extension for prevention, including gingival extension under the free margin of the gum. This statement requires some elaboration.

In his close study of beginning caries of enamel, Black concluded that caries never occurred under the free margin of healthy gum tissue. This was purely a clinical observation. He considered the enamel to be immune from beginning caries as long as it was covered by healthy gingivae. This observation led to the recommendation that the gingival margins of cavities be placed under the gingivae and that contours and contacts be so restored as to assure the future health of the gingivae.

The more recent work of Gottlieb[18, 19] on the epithelial attachment of the gingivae to the enamel, confirmed by such leading histologists as Noyes,[20] Orban,[21] Kronfeld[22] and Bodecker,[23] has caused some men to question the practice of gingival extension for the prevention of future decay.

In writing of the epithelial attachment, Orban says:

> Formerly it was supposed that after the tip of the crown had broken through the mouth epithelium, a space existed between the enamel epithelium and the enamel, which space extended to the cemento-enamel junction (called "sub-gingival space"). Since 1921 we know from the work of Gottlieb that this conception is false and

that no space exists between the enamel and the enamel epithelium. . . . A probe placed in the space between the epithelium and the enamel will not reach the cemento-enamel junction, but stops at the point where the enamel epithelium is attached to the enamel or enamel cuticle.

Kronfeld writes:

The former concept of the relationship between tooth and gingivae was that the gingivae are attached to the tooth at the cemento-enamel junction. The soft tissues crownward from the cemento-enamel junction were called the free gingivae. Investigations have shown that the condition just described does not exist and, consequently, all theoretical and practical considerations based on this concept had to be changed.

Orban and Mueller[24] have been severely critical of Black's teaching, although they acknowledge that his clinical observations with respect to beginning decay were correct. They quote Black thus:

Therefore, if decays in this position (gum margin, Ref.) have begun in the child, they may be mid-length the crown when the child has arrived at adult age. Therefore the particular position of the beginning of these decays on the buccal surfaces will depend much on the age of the patient at the time of their beginning. They are, however, always near the free border of the gingivae at the time of their beginning. If such cavities are filled for young persons without pushing the gingivae well back in each case so that the border of the cavity can extend well under it, the natural shrinkage of the gingivae will soon expose the enamel between the gingivae and the filling. This will then be liable to decay again.

In commenting on this quotation from Black, the authors[25] say:

Here is the practical conclusion, and we see clearly where the mistake was made. We cannot push the gum back far enough to keep the fillings permanently under the gum. If the gum is healthy, as Black requires it to be for protection, the free gingiva is very short, and there is practically no crevice. If we force the gum away, we separate the epithelial attachment from the tooth, and by so doing, we injure and damage the supporting structures.

Such statements as quoted above have cast a heavy shadow of doubt on the practice of gingival extension for prevention of future decay and no doubt have served to confuse some conscientious young dentists who desire to render the best possible service to their patients. The criticisms by Orban and Mueller, then, are that extension gingivally under the gum does not protect the gingival margin of a restoration permanently and that the supporting structures are damaged by extension. These criticisms warrant closer examination.

Until the time that Black crystallized the best thought and practice of the dental profession and gave it the name "extension for prevention,"[26] dentists the world over were meeting with failure after failure in their attempts to restore carious teeth by means of fillings with some degree of permanence. The best contoured restorations of gold foil would fail from time to time because of recurrence of decay around the margins. As the knowledge of the pathology of dental caries became more general and the principle of cavity outline better understood, these failures decreased in number and dentists could be confident that their restorations would give years of useful service. Much of this success was the result of the gingival extension under the gum. I have seen many restorations, particularly proximal, that were made by G. V. Black, Thomas L. Gilmer, Arthur D. Black and others of less prominence, but no less skill, that have endured from thirty to forty years. In these cases, the gingival margins had always been placed under the gingivae. Thousands upon thousands of dentists have observed this in connection with their own operations. Have these gingival margins always remained under the gingivae as the years went on? Not always, by any

means. The important point in this connection is that the gingival margin of the restoration remains covered by the healthy gum during the early years of greatest susceptibility to caries. The shortening of the gingivae goes on naturally as age advances. Also relative, if not complete, immunity is commonly attained in adult life. In those cases in which the gingivae have shortened in later years to the point of exposing the gingival margin of the restoration, natural immunity has served to lend permanence to the restoration.

Do such extensions "injure and damage" the supporting structures? This question should be answered by the dentist who observes the results of his efforts year after year rather than by the histologist who reports the existence of the epithelial attachment to the enamel. Of course, injury can be done, and often is done, by careless operators or by accident. But when reasonable precautions are observed in operating, the good that can be accomplished in preventing the recurrence of caries far outweighs the harm, if any, that might result to the gingivae. In this connection, the fact should be emphasized that G. V. Black continually cautioned his students that the gingivae should not be injured during operations and that the contours and contacts of restorations should be so formed that the gingivae would be permanently protected against injury. Moreover, Black did not advise radical retraction of the gum. It was certainly never his intention that the gingival margins of cavities should be extended to the cemental line. A close study of any of his textbooks fails to disclose one illustration of a prepared cavity that shows the gingival margins thus extended.

It was recognized by Black that there was no fixed formula which would govern every case. There was always an exception to the rule. This was true with respect to the principle of extension for prevention. Dr. Black emphasized the principles upon which sound operative procedures were based without ever stating in exact terms just how each case should be treated. His rules governing cavity outline are stated in terms which leave the details to the operator. There are dentists, however, who believe that Black's directions for gingival extension of cavities were not given in sufficient detail. For this reason, I shall attempt to give a more specific interpretation of Black's ideas, although it may appear presumptuous to do so:

1. All carious enamel and enamel undermined by carious dentin should be removed. (In many instances, this alone will carry the gingival margin under the gum.)

2. In young persons—that is, adolescents and young adults—the cavities, almost invariably, should be extended under the gum. The gingival margin should not be in near proximity to the proximal tooth. Where the teeth are thick-necked and the proximal surfaces lie close together for a considerable distance occlusogingivally, cavities should generally be extended farther gingivally than would otherwise be necessary.

3. In adult and middle-aged patients, if the gingivae have not been shortened appreciably, the cavities should be extended under the gum unless there are definite signs of immunity to caries. If immunity has been established, extension under the gum should not be necessary.

4. In elderly patients or younger patients, if the gum has receded considerably, it is usually unnecessary to make gingival extensions.

These recommendations are made after full consideration of the comparatively recent knowledge pertaining to the epithelial attachment. Clinically, this attachment is difficult to demonstrate. Apparently, it is a frail structure. Perhaps the epithelium is detached and reattached from time to time. If the maintenance of this attachment were as

important as some men seem to think it is, all clinical practice would need to be radically revised. Clinical experience, however, does not justify a change in operative procedure.

There are times, of course, when it is necessary to use temporary materials in proximal cavities. We should use them sparingly. Loss of contact during early adolescence frequently results in harm to the gingivae that cannot be repaired later, and drifting of the teeth, due to the loss of mesiodistal width, affects the entire denture deleteriously. Permanent restorations—well adapted, contoured and finished—preserve the teeth, protect the gingivae and maintain the integrity of the arch.

The anterior teeth offer an even more difficult problem because of the esthetic requirements. Dr. Prime has urged the use of silver nitrate to immunize the proximal surfaces of these teeth, pointing out how fortunate is its effectiveness here because of the difficulty of making restorations that look well. In spite of all our endeavors to prevent caries, restorations will be required from time to time. I believe it is the consensus of the best operators that gold foil restorations are the best when properly employed. However, conditions are frequently unfavorable for their use and something else must be employed. Usually, the substitute is silicate cement. The use of this material has been condemned and condoned. Apparently, it is with us to stay.

If our program of tooth conservation is to be successful, the silicate cements must be used cautiously, if at all. In their use, extension for prevention should be largely ignored. Contacts should be on tooth structure rather than on filling material, as this material will not hold contours very long. Where the contact point must be made on the filling, it should be expected that the filling will have to be replaced within a year or two. The pulp should be amply protected with a suitable cavity lining. But when all the necessary precautions are taken, trouble is still apt to follow. Proximal contacts will be lost and the teeth will drift. The gingivae will become inflamed and resorption of the alveolar process will follow. Since the cement gives it no support, the incisal angle frequently is fractured and lost. Many men, of course, recognize these conditions and use porcelain jacket crowns, with which normal contour and contact can be restored and maintained. But a porcelain jacket crown, although it may be a thing of beauty, is not always a joy forever. In its use, gingival irritation and death of the pulp become a constant menace to oral health. Much of this threat to the health of the dental pulp and to the integrity of the dental arch may be removed by the use of gold foil restorations or an occasional gold inlay, well timed and well placed. The intelligent, conscientious operator will not be indifferent to this fact.

This problem of tooth conservation, then, is indeed a difficult one. Yet, by the application of our present knowledge of prevention through control of the diet, immunization, mouth hygiene and treatment by means of restorations, it should be, and usually is, possible to bring a patient from preschool age to adult life without the loss of a pulp and with healthy supporting structures.

The adult period is usually marked by lessened susceptibility to caries and by an increased tendency to inflammation of the gingivae and resorption of the alveolar process. Caries is much easier to control during this period, but it does not follow that we can admit of any laxity on the part of patients in presenting themselves for periodic examination or on our part in making thorough examinations. As the gingivae gradually shorten and the alveolar process gradually resorbs—a natural phenomenon—proximal contacts may weaken and food leak in between the teeth and cause ca-

ries near the cemental line. Or pus pockets may be established. It is imperative that these conditions be watched for and corrected whenever or wherever discovered.

It will be necessary to replace restorations from time to time because of recurrent caries, or to correct contours and rebuild contacts. Only if these conditions are studied carefully and corrected can the integrity of the arch be maintained for years. It is not my intention to imply here that this plan of treatment will prevent all so-called pyorrhea. It is expected, however, that, in a high percentage of patients, a healthy condition of the natural dentures can be maintained well into advanced years or even throughout the life span.

This program which I have outlined is not original, of course. I have drawn heavily upon the experience and writings of Arthur D. Black and of others. It represents merely the ideal toward which many of us strive. Besides a great deal of hard work on your part and mine, it calls for patience and perseverance; and, by all means, it calls for a secretary who will tactfully and persistently see to it that the patients come in at the proper time for examination.

I am convinced that there is no phase of dentistry which offers greater opportunity for service than prevention. The dentist who recognizes this fact and cares for his patients in such a way as to conserve their teeth in function and health during the childhood period of greatest susceptibility to dental caries, and on through the adult period of greatest damage to the investing tissues, renders invaluable health service. The problem of focal infection as it concerns dentistry will be well on the way to solution when the dental profession as a whole has learned to apply the knowledge and employ the technics that are now available.

Recently, in discussing this subject, Charles W. Freeman made a statement which I strongly recommend that we adopt as a slogan: "Every dentist engaged in general practice should be a specialist in prevention."

BIBLIOGRAPHY

1. BLACK, G. V.: Operative Dentistry. Chicago: Medico-Dental Publishing Co., 1917, p. 2.

2. *Idem:* Operative Dentistry. Ed. 7, revised, 1936, by Arthur D. Black. Chicago: Medico-Dental Publishing Co., Vol. 1, p. 1.

3. MILLER, W. D.: Micro-Organisms of the Human Mouth. Philadelphia: S. S. White Dental Manufacturing Co., 1890.

4. WILLIAMS, J. L.: Contribution to Study of Pathology of Enamel. *D. Cosmos,* 39:269, April 1897.

5. Research Commission of the American Dental Association: Dental Caries, 1939.

6. MAGITOT, E.: Treatise on Dental Caries. Boston: Haughton, Osgood and Co., 1878. (Original French, 1867).

7. BUNTING, R. W.: What Procedures Can Be Instituted in Infant and Pre-School Life of Child for Prevention and Control of Dental Caries? J.A.D.A., 26:377, March 1939.

8. JAY, PHILIP: Rôle of Sugar in Etiology of Dental Caries. J.A.D.A., 27:393, March 1940.

9. HOWE, P. R.: Food Accessory Factors in Relation to Teeth. *J. D. Res.,* 3:8, March 1921.

10. *Idem:* Studies of Dental Caries Following Experimental Feeding with Monkeys. J.A.D.A., 2:1157, December 1924.

11. SEBRELL, W. H.: Nutrition in the United States. *J.A.M.A.,* 115:851, September 7, 1940.

12. STEPHAN, R. M.: Changes in Hydrogen Ion Concentration on Tooth Surfaces and in Carious Lesions. J.A.D.A., 27:718, May 1940.

13. FOSDICK, L. S., and CAMPAIGNE, E.: *J. D. Res.,* 18:261, June 1939.

14. PRIME, J. M.: Further Extending Use of Howe's Ammoniacal Silver. *D. Cosmos,* 77: 1046, November 1935.

15. BLACKWELL, R. E.: Clinical Examination for Susceptibility to Dental Caries. *Northwestern Univ. Bull.,* 37:11, August 1937.

16. HADLEY, FAITH P.: Quantitative Method for Estimating B. Acidophilus in Saliva. *J. D. Res.,* 12:415, October 1933.

17. BODMER, EUGENE: Caries Diagnosis. *Illinois D. J.*, 9:8, January 1940.

18. GOTTLIEB, BERNHARD: Der Epithelansatz am Zahne. *Deutsche Monatschr. f. Zahnheilk.*, 21:142, 1921.

19. *Idem:* What Is a Normal Pocket? J.A.D.A., 13:1747, December 1936.

20. NOYES, F. B.; SCHOUR, ISAAC, and NOYES, H. J.: Dental Histology and Embryology. Ed. 5. Philadelphia: Lea and Febiger, 1938, p. 67.

21. ORBAN, BALINT: Dental Histology and Embryology. Ed. 2. Philadelphia: P. Blackiston's Son & Co., Inc., 1929, p. 100.

22. KRONFELD, RUDOLF: Histopathology of Teeth and Surrounding Structures. Ed. 2. Philadelphia: Lea and Febiger, 1939, p. 287.

23. BODECKER, C. F., and LEFKOWITZ, WILLIAM: Gingival Attachment to Enamel and Its Relation to Operative Dentistry. *D. Cosmos*, 77:1106, November 1935.

24. ORBAN, BALINT, and MUELLER, EMIL: Gingival Crevice. J.A.D.A., 16:1239, July 1929.

25. ORBAN and MUELLER, reference 24, p. 1240.

26. BLACK, G. V.: Management of Enamel Margins. *D. Cosmos*, 33:85, February 1891.

180 North Michigan Avenue.

RELATIONSHIP BETWEEN GINGIVAL HYPERPLASIA AND ASCORBIC ACID IN THE BLOOD AND URINE OF EPILEPTIC PATIENTS UNDERGOING TREATMENT WITH SODIUM 5, 5-DIPHENYL HYDANTOINATE*

By JERRY A. MILLHON, D.D.S., and ARNOLD E. OSTERBERG, Ph.D., Rochester, Minn.

THIS study was undertaken in an attempt to determine whether a relationship exists between gingival hyperplasia, which is occasionally seen, and the ascorbic acid content of the blood and urine of patients suffering from epilepsy and undergoing treatment with sodium 5, 5-diphenyl hydantoinate (dilantin sodium).

ANTECEDENT STUDIES

Kimball,[1] Frankel,[2] Fetterman,[3] Merritt and Foster,[4] Hodgson,[5] Thoma[6] and Glickman and Lewitus[7] have reported cases in which gingival hyperplasia was noted among persons taking dilantin sodium for epilepsy. Kimball first expressed the belief that gingival hyperplasia could be a result of deficiency of vitamin C induced by dilantin therapy, and his belief has more or less been accepted. He studied 119 patients for the presence of hyperplasia of the gums, and, of these, fifty-one had normal gums and sixty-eight had gums that exhibited varying degrees of hyperplasia. Kimball stated that no patient who had normal gums was found to have a deficiency of ascorbic acid and that, conversely, every patient who had marked hyperplasia of the gums also had a definite deficiency of vitamin C. He concluded that the degree of deficiency of ascorbic acid parallels the degree of hyperplasia of the gums present.

Frankel, in a study of forty-eight pa-

From the Section on Dental Surgery and the Division of Biochemistry, Mayo Clinic.

*Dilantin sodium, Parke Davis & Company.

tients who were taking dilantin sodium, arrived at similar conclusions.

However, in a report[8] of the Council on Pharmacy and Chemistry of the American Medical Association on dilantin sodium, it was stated that "results of the experiments on animals did not indicate that the drug has any influence on the utilization of ascorbic acid." Gruhzit,[9] in studies carried out with dilantin sodium on different animals, was able to show that dilantin sodium has no effect on the utilization of vitamin C or vitamin B_1.

Merritt and Foster found that the content of ascorbic acid in the plasma of 257 ambulatory patients suffering from convulsive seizures varied between 0.0 mg. and 1.6 mg., with an average of 0.45 mg. per hundred cubic centimeters. They also demonstrated that the content of ascorbic acid in the plasma of these patients was in no way influenced by the type of therapy employed. Also, the long continued administration of dilantin sodium had no effect on the ascorbic acid content of the plasma, and did not influence the absorption of vitamin C when the drug was given by mouth. Twenty-two per cent of patients who were receiving dilantin sodium had some degree of gingival hyperplasia. Merritt and Foster showed, however, that the hyperplasia of the gingivae which occasionally develops among patients under treatment with dilantin sodium is not related to the ascorbic acid content of the plasma or to the utilization of vitamin C. Finally, they showed that a low content of ascorbic acid in the plasma of clinic patients suffering from epilepsy actually is caused by an inadequate intake of this element. This was demonstrated when the ingestion of food with a vitamin C content by patients who had low values for ascorbic acid in the plasma resulted in a five-fold increase in such values.

Glickman and Lewitus and Thoma made microscopic examinations of hyperplastic gingival tissue from persons in whom such hyperplasia had appeared after dilantin sodium therapy. They demonstrated microscopically that the stratum mucosum of the epithelial layer showed thickening, and this resulted in thickening and down growth of the epithelial rete, with scattered pearl formation. The corium exhibited edema of the papillary layer and an increase in the collagen fibrils. There was also an increase in connective tissue cells.

THE PRESENT STUDY

Our investigations were made at the Minnesota Colony for Epileptics at Cambridge.

Classification of Patients.—Determinations were made of the content of ascorbic acid in the blood and urine of eighty-two persons, who were divided into three main groups: Group 1, seventeen patients receiving dilantin sodium only; Group 2, thirteen patients receiving phenobarbital in combination with dilantin sodium, and Group 3, fifty-two patients (the control group), who would not consent to administration of dilantin sodium or were not receiving it for other reasons. All eighty-two persons were subsisting on the same daily diet.

Determination of Ascorbic Acid in Blood and Urine.—The procedures that were used in determination of the content of ascorbic acid in the blood and urine have been described in detail by Magnusson and one of us (A. E. O.[10]). Determinations of ascorbic acid in the blood were carried out according to the method of Taylor, Chase and Faulkner,[11] and the suggestion of Pijoan and Klemperer[12] was utilized. The method used for determination of the cevitamic acid content of the urine was the technic outlined by Harris and Ray.[13]

The ascorbic acid content of the blood plasma was determined after a twelve-hour fast. The twenty-four hour urinary

excretion of ascorbic acid was determined. It is expressed herein in terms of total milligrams of ascorbic acid excreted in twenty-four hours.

First, it seemed of paramount importance to determine the normal content of ascorbic acid in the blood plasma of patients residing in an institution in which the consumption of foods abundant in vitamin C is limited because of economic factors.

Control Group.—As a result, the main group, Group 3 (the fifty-two controls), was further divided into two subgroups. One subgroup (Group 1a) consisted of twenty-two persons who were subject to epileptic seizures, but who would not consent to medication. The second control subgroup (Group 1b) consisted of thirty persons who were not subject to epileptic seizures and who had not received medication.

The average content of ascorbic acid in the blood plasma of members of the first control group (Group 1a) was 0.44 mg. per hundred milliliters of plasma. Among members of the second control group (Group 1b), it was 0.49 mg. per hundred milliliters of plasma. These values are rather low as compared to the commonly accepted normal value for ascorbic acid or from 0.9 to 1.5 mg. per hundred milliliters of plasma. The average twenty-four hour output of ascorbic acid in the urine in the first control group (Group 1a) was 4.4 mg. In the second control group (Group 1b), the amount of ascorbic acid excreted in the urine in twenty-four hours was 5.9 mg. These amounts also are considered to be low, in comparison to the commonly accepted normal daily output of ascorbic acid in the urine of from 10 to 30 mg.

Since the content of ascorbic acid in the blood and urine was comparatively the same for the two control subgroups, the values for the two subgroups were combined. The average content of ascorbic acid in the blood plasma of the two control groups was 0.46 mg. per hundred milliliters of plasma, and the average amount of ascorbic acid excreted in the urine during a twenty-four hour period for the fifty-two persons was 5.15 mg.

Epileptic Patients Receiving Dilantin Sodium Only.—There were seventeen patients in Group 1 (those who had had epileptic seizures and for their medication were receiving dilantin sodium only). The average amount of ascorbic acid found in the blood plasma of these seventeen persons was 0.42 mg. per hundred milliliters, and the average amount of ascorbic acid excreted in the urine in twenty-four hours by these patients was 5.9 mg. These values are decidedly less than normal, but are relatively similar to those observed in the two control subgroups (Groups 1a and 1b of those in Group 3).

Epileptic Patients Receiving Dilantin Sodium and Phenobarbital.—Thirteen persons in Group 2 (those who had epileptic seizures and who were receiving phenobarbital in addition to dilantin sodium) had an average content of ascorbic acid in the blood plasma of 0.48 mg. per hundred milliliters of plasma. The average quantity of ascorbic acid excreted in the urine of these persons was 6.02 mg. Again it is apparent that even in this group the values are less than those considered to be normal (from 0.9 to 1.5 mg. per hundred milliliters of plasma and from 10 to 30 mg. per milliliter of urine), yet are similar to the values obtained in the control group (Subgroups 1a and 1b), as well as among those persons who received dilantin sodium only.

Condition of Gingivae. — Control Group.—In neither of the control subgroups was there evidence of any gingival hyperplasia. Among persons who showed poor daily oral care, there was evidence of mild hypertrophy of the

gums. The septal gingivae were affected, appearing to be smooth and very red, and exhibiting a tendency to bleed easily. The gums of patients who were receiving dilantin sodium and who had hyperplasia of the gingivae appeared to be lobulated, were a nearly normal pink and had no tendency toward bleeding.

Group 1.—The average age of the seventeen persons in Group 1 (those who had had epileptic seizures and were receiving dilantin sodium only) was 23+ years, the range being between 16 and 34 years. These seventeen persons were receiving an average daily dose of 4+ grains (0.26 gm.) of the drug. The largest daily dose received was 4½ grains (0.28 gm.); the smallest, 3 grains (0.2 gm.). The average length of time these persons had been receiving dilantin sodium was nine and nine-tenths months, the range being from four to twenty-four months. Evidence of gingival hyperplasia was found among six of these seventeen patients, or in about one of every three patients. Gingival hyperplasia was noted in the labial interproximal spaces in three of these six patients, in the buccal interproximal spaces in one of the six patients and in the labial and buccal interproximal spaces of the remaining two patients. Hyperplasia of the lingual gingival tissue was not noted. Two persons were completely edentulous and two persons had edentulous maxillae. In none of these edentulous or semi-edentulous persons was there evidence of hyperplasia of the gingiva overlying the edentulous portions. Gingival tissues about the six lower anterior teeth were most often affected, five of the six persons who had hyperplasia giving evidence of it in this region. Other gingival areas in which hyperplasia was noted were the upper bicuspid region and the region of the lower first and second molar teeth. The degree of gingival hyperplasia was considered mild. Hyperplasia was graded on a basis of 1 to 4. Except in one case, the degree of hyperplasia present was graded as 1. In the exceptional case, the degree was more severe and was graded 2. In none of the cases in which gingival hyperplasia was present was it of an inflammatory type.

It seemed evident that gingival hyperplasia was not influenced by daily oral hygiene. Five of the persons in this group who had hyperplasia of the gingival tissues had given excellent daily attention to their teeth and gums. In only one case in which gingival hyperplasia was present was the daily oral care of a poor standard.

Group 2.—The thirteen patients in Group 2 (those who had had epileptic seizures and were receiving phenobarbital with dilantin sodium) were of an average age of 21+ years, the range of age being from 9 to 36 years. An average dose of 3 grains (0.2 gm.) of dilantin sodium was received daily by these thirteen persons. The largest daily dose received was 4½ grains (0.28 gm.); the smallest, 1½ grains (0.1 gm.). The thirteen persons had been receiving dilantin sodium for an average of eight and four-tenths months, the range being from three to twenty-four months. In addition to dilantin sodium, these persons also had been receiving an average of 1.9 grains (about 0.12 gm.) of phenobarbital daily. The largest daily dose of phenobarbital received was 3 grains (0.2 gm.); the smallest, three-fourths grain (0.05 gm.).

Gingival hyperplasia was found in six of these thirteen patients, or about one of every two patients. Four of these six patients had gingival hyperplasia in the labial interproximal spaces and the other two had the condition in the buccal interproximal spaces. One person exhibited lingual areas of gingival hyperplasia, as well as hyperplasia of the labial gingivae of the upper and lower anterior teeth. Two persons in Group 2 had edentulous

maxillae. As was the case in Group 1, there was no evidence of gingival hyperplasia in the gingivae of the edentulous regions. Interestingly enough, one patient from whom the teeth in the superior maxillae had been removed gave no evidence of gingival hyperplasia in the edentulous regions, but in the lower jaw, where the teeth were present, the labial interproximal spaces of the lower anterior teeth were hyperplastic.

The gingival tissues of the anterior upper and lower teeth were most often involved, three of the six patients in Group 2 having hyperplasia in this area. In only one case was the lower anterior gingiva involved and the maxillae were edentulous. In one other case, the interproximal buccal spaces of the upper left first and second bicuspid teeth were involved with hyperplasia. In the remaining case, hyperplasia of the buccal interproximal spaces was present, bilaterally from the second bicuspid to the second molar in the maxillae.

The degree of gingival hyperplasia present was more marked in this group of patients than in the previous group (Group 1). All except two of the six patients who had hyperplasia had grade 2.

In no case was gingival hyperplasia of an inflammatory type.

All the cases in this group served to demonstrate again that oral hygiene does not play a part in the incidence of the lesion, because examination of the mouths of five of the six persons who had gingival hyperplasia showed that the gums and teeth had received excellent daily care. The mouths of the majority of persons in Groups 1 and 2, who were undergoing treatment with dilantin sodium, showed no gingival hyperplasia, yet evidenced poor daily care.

The relationship between the two series of data (that is, concerning the thirty persons receiving sodium dilantin therapy and the fifty-two controls not receiving such therapy) established our hypothesis that gingival hyperplasia, occasionally observed among patients receiving dilantin sodium for epileptic seizures, is not caused by a deficiency of vitamin C induced by the drug.

In each person, the value for ascorbic acid in the blood and the amount of it recovered from the urine were much lower than the values commonly considered to be normal. Enough persons had markedly lowered values for ascorbic acid in the blood and urine to justify the inference that gingival hyperplasia would have occurred more often than it did if gingival hyperplasia had been the result of deficiency of vitamin C.

SUMMARY

A total of eighty-two patients were studied. Thirteen of the thirty epileptic patients who received dilantin sodium also received phenobarbital. Seventeen of the thirty patients received dilantin sodium alone.

In all cases, the values for ascorbic acid obtained were less than those considered to be normal. Values for ascorbic acid in the blood plasma and in the urine of those patients who received dilantin sodium were comparable to similar values among those persons who received no medication.

Gingival hyperplasia was not found among any of the twenty-two persons who had epileptic seizures and who would not consent to dilantin sodium therapy. Gingival hyperplasia was found among six of the seventeen patients who had epileptic seizures and were receiving only dilantin therapy. Evidence of gingival hyperplasia was found among six of the thirteen patients who had epileptic seizures and were receiving phenobarbital in conjunction with dilantin sodium.

Regions of the mouth most susceptible to gingival hyperplasia were the gingival tissues about the upper and the lower

anterior teeth. Gingival hyperplasia was not found in edentulous areas in any patients. The gingival hyperplasia was never of an inflammatory type. Poor oral hygiene was not found to play a part in the incidence of the lesion. Gingival hyperplasia occurred only among those patients who were receiving dilantin sodium. The extent of gingival hyperplasia present apparently was not governed by the amount of the drug taken. There was no relationship between dilantin therapy and the ascorbic acid content of the blood plasma and the rate of excretion of ascorbic acid in the urine.

CONCLUSION

A group of persons subsisting on an institutional diet exhibited moderate deficiency of vitamin C. Gingival hyperplasia occurred only among those persons who were receiving dilantin therapy, and the ascorbic acid content of the blood plasma and the excretion of ascorbic acid in the urine were not affected by the administration of dilantin sodium.

BIBLIOGRAPHY

1. KIMBALL, O. P.: Treatment of Epilepsy with Sodium Diphenyl Hydantoinate. *J.A.M.A.*, 112:1244-1245, April 1, 1939.

2. FRANKEL, S. I.: Dilantin Sodium in Treatment of Epilepsy. *J.A.M.A.*, 114:1320-1321, April 6, 1940.

3. FETTERMAN, J. L.: Dilantin Sodium Therapy in Epilepsy; Report of Study in Progress. *J.A.M.A.*, 114:396-400, February 3, 1940.

4. MERRITT, H. H., and FOSTER, ALTHEA: Vitamin C in Epilepsy. Dilantin Sodium Not a Cause of Vitamin C Deficiency. *Am. J. M. Sc.*, 200:541-544, October 1940.

5. HODGSON, E. R., and REESE, H. H.: Clinical Experiences with Dilantin in Epilepsies. *Wisconsin M. J.*, 38:968-971, November 1939.

6. THOMA, K. H.: Dilantin Hyperplasia of Gingivae. *Am. J. Orthodontics*, 26:394-396, April 1940.

7. GLICKMAN, I., and LEWITUS, M. P.: Hyperplasia of Gingivae Associated with Dilantin (Sodium Diphenyl Hydantoinate) Therapy. J. A.D.A., 28:199-207, February 1941.

8. Report of Council on Pharmacy and Chemistry: Dilantin Sodium. *J.A.M.A.*, 113: 1734-1735, November 4, 1939.

9. GRUHZIT, O. M.: Sodium Diphenyl Hydantoinate: Pharmacologic and Histopathologic Studies. *Arch. Path.*, 28:761-762, November 1939.

10. MAGNUSSON, ARLENE E., and OSTERBERG, A. E.: Determination of Cevitamic Acid in Blood and Urine. *Proc. Staff Meet., Mayo Clin.*, 13:700-702, November 2, 1938.

11. TAYLOR, F. H. L.; CHASE, DORRANCE, and FAULKNER, J. M.: Estimation of Reduced Ascorbic Acid in Blood Serum and Plasma. *Biochem. J.*, 30:1119-1125, 1936.

12. PIJOAN, M., and KLEMPERER, F.: Determination of Blood Ascorbic Acid. *J. Clin. Investigation*, 16:443-445, May 1937.

13. HARRIS, L. J., and RAY, S. N.: Diagnosis of Vitamin-C Subnutrition by Urine Analysis with Note on Antiscorbutic Value of Human Milk. *Lancet*, 1:71-77, January 12, 1935.

RACE BETTERMENT THROUGH PREVENTIVE DENTISTRY

By Weston A. Price, D.D.S., M.S., Cleveland, Ohio

MODERN civilization is in a dilemma. The biggest problem in the world today is not war, but means for race betterment. Epidemics, plagues and infectious diseases are largely under control. Today, the members of the healing professions are engaged in alleviating suffering from degenerative diseases by means of remedial surgery and makeshift repairs.

A prime requisite is a new orientation; first, for recognizing our dilemmas, and second for establishing educational programs and leadership for human conservation through race betterment. As an aid to this new orientation, let us note the observations of some of our leaders in social sciences.

1. Modern man is delicate. . . . The organism seems to have become more susceptible to degenerative diseases. (Carrel.)

2. Nearly one-third of the whole population (of two dozen states) is of a type to require some supervision. (Laird.)

3. Of 2,000,000 babies to be born in 1941, 738,386 will be wholly or partially wasted, 37%. (Nat'l Committee for Planned Parenthood.)

4. Measurable brain can be correlated with testable mind. (Waverly Researches.)

5. Thinking is as biologic as digestion. (Thorndike.)

6. Of all the psychological causes of crime, the commonest and gravest is usually alleged to be a defective mind. . . (Burt.)

7. . . . Gross human congenital malformations arise solely from influences which affect the germ cells prior to fertilization. . . . (Murphy.)

8. Eggs (fertilized ova) are not all of equal quality, 25% are not good enough to be born as living individuals. (Streeter.)

9. It is store food which has given us store teeth. (Hooton.)

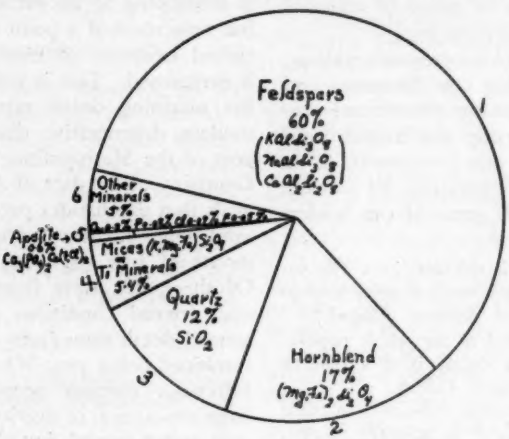
10. There is a nutritional basis for modern physical, mental and moral degeneration. (Price.)

These quotations are from the textbook "Nutrition and Physical Degeneration: A Comparison of Primitive and Modern Diets and Their Effects."

Evidence of our modern degeneration is developing at an increasing rate and has now reached a point where the continued existence of modern civilization is threatened. This is well illustrated in the alarming death rate from several modern degenerative diseases. The report of the Metropolitan Life Insurance Company under date of August 1941 reveals that death rates per hundred thousand policy holders had reached, for the month of July 1941, 714 for all causes. Of these, 185 were from heart disease and arterial conditions and 100 from cancer, death rates from all other causes combined being 429. Whereas, formerly, infectious diseases accounted for the large proportion of deaths, these are now well under control, but the degenerative diseases have increased to such an alarming extent that in this total of 714 deaths for the month of July for each hundred thousand policyholders, the degenerative diseases now constitute 420, or 60 per cent, of the total. Of the degenerative diseases, conditions of the heart and arteries and cancer took 285, or 40 per cent; while all of the other causes took only 293, or 40 per cent. The latter number included automobile accidents. Even this wastage of human life is not adequately expressed by a consideration of the principal causes of death after birth; since of every hundred pregnancies in the United States, twenty-

five are reported to end before term.

In order that we may get a bird's-eye view of simply one factor in progressive modern degeneration, let us consider the problem of depletion of soils. In Figure 1, we see expressed diagrammatically the ratio of the various minerals that make up the soil of the earth from which all our plant foods must develop. It is of interest that calcium and phosphorus are limited to the small section at the left of the circle. Calcium and phosphorus, in the group of minerals classed as apatite, constitute only a minute percentage of the earth's surface. These two minerals, we must realize that the top 7 inches of an acre of ground contains only about 1,000 pounds of phosphorus in a chemical form in which plants can use it. Now when we realize that a 60-bushel crop per acre of wheat or corn will remove from the soil about 25 pounds of phosphorus per acre, or one-fortieth of the total content of the top 7 inches, we are immediately confronted with the fundamental, controlling problem that we have, accordingly, only enough phosphorus in the average soil for forty excellent crops. This is why we see so many farms that have been abandoned



Soil Minerals as Provided by the Original Source, the Igneous Rocks.

Figure 1.

forming as they do the principal constituents of bone, are in greatest demand in the growth of animal life.

It will aid us in visualizing the difficulties involved in obtaining these minerals by plants and animals to observe with regard to phosphorus that it constitutes only about one part in 1,000 of the earth's crust. Plants, dry weight, require about 30 parts per thousand; while animals with skeletons, dry weight, require it in the ratio of 100 parts in 1,000. The only source of phosphorus is the soil on which the plants grow, and because they have been exhausted of their minerals, particularly phosphorus. It is also the reason that the annual death rates are so rapidly increasing in certain parts of the country, particularly those districts that have been longest settled or where the soil is shallowest.

While it is true that only about one-thousandth of the original earth's surface consists of available phosphorus, Nature's system of management of plant and animal life provides for an accumulation of the minerals most used by increasing the concentration of these

minerals on the surface of the soil. In Nature's program, plants and animals return to the earth what they borrow. The roots of plants, large and small, particularly forests, bring up the required minerals from the various depths to which the roots penetrate and deposit them as fallen leaves and trunks, to decay on the surface. By this method, Nature builds an enriched top soil, production of one inch of which requires 400 years. Our prairies have from 4,000 to 10,000 years of accumulated top soil, which greatly reinforces the capacity of the surface for plant growth. The top soil is normally held by the roots of grasses and shrubs. When the roots are all removed, the wind and water rapidly carry away top soil, chiefly to the ocean, where it is lost for human use.

Fig. 2.—Cattle that died because pasture was so poor that it could not sustain life.

The death rate from heart disease in 1925 as reported by the American Heart Association has for many areas increased 50 per cent or more, in the last fifteen years. The states of New England and those bordering the Great Lakes, together with the Pacific coast states, constitute the areas where the death rates are the highest, and these are the areas that have been occupied for the longest time. Large areas of these states now have a greatly reduced capacity for human maintenance, requiring that food be shipped in from other areas.

My studies of this problem of reduced capacity of soils for maintaining animal life have included correspondence with the agricultural departments of all of the states of the union with regard to maintaining cattle. The reduction in capacity ranges from 20 to 90 per cent, and large areas are reported to carry successfully now only 50 per cent as many head of cattle as formerly. I am advised that it would cost $50 an acre to replace the phosphorus alone that has been shipped off the land in large areas.

There is an important fact that we should consider; namely, the rôle that has been played by glaciers in grinding up and distributing rock formations. One glacier, the movement of which affected the surface soil of Ohio, covered only about half the state; namely, that area west of a line starting east of Cleveland and extending diagonally across the state

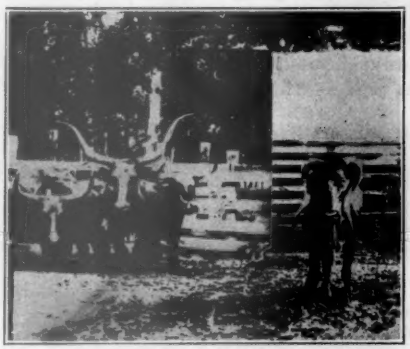


Fig. 3.—Steer with long horns sagging because of demineralization after animal was removed from good pasture to poor one.

to Cincinnati. It is important for us to note that, in the areas south and east of this line, several expressions of degeneration are higher than in the areas north and west of this line. The infant mortality per thousand live births in 1939 is very informative. In the counties north and west of that line, the death rate was from 40 to 49 per thousand live births; whereas, in the area south and east of that line, the death rate was from 50 to 87.

It is of particular interest to us as dentists that studies show the percentage of teeth with caries to be much higher

southeast of this line than northwest of it.

The effect of depletion of soils on animal life is striking. In a district in which I was studying this phase of the problem, I examined ranch cattle that were pasturing on a badly depleted soil where there was adequate water. These cattle had been shipped into the area to provide food for human beings. In one district, in traveling about 5 miles, I counted ten head of cattle that had starved to death for certain minerals that had been depleted from the soil. A typical example is shown in Figure 3.

Another excellent illustration of the effect of change of pasturage on cattle is shown in Figure 3. A number of well-fed long horn cattle were transferred from a good district to a poor one. Figure 3 shows two views of the same steer, at the left while pasturing on a good soil

Fig. 4.—Residue of bread (left) of sufficient nutriment that one-half slice supported bugs skeletons of which are shown at right.

and at the right after being transferred to pasture on a depleted soil, indicating the results of depletion of the soil of minerals. Because the long rangy horns have been demineralized at their base, they have dropped down so that their tips extend far below the nose and mouth. This condition constituted a barrier to eating grass because the horns prevented the animal from reaching its food. In the picture to the right, the steer is badly emaciated.

Another approach to this important problem is directly related to the quantity of animal life, large and small, that can be maintained on grain food such as flour. This is of special concern because of the effect of depletion of our cereal foods of natural minerals and vitamins. Modern white flour has had approximately four-fifths of the phosphorus and nearly all of the vitamins removed, in order to produce a flour that can be shipped without becoming infested with insect life. I have been advised by millers that they could not ship flour if the minerals and vitamins were not removed. At once, we have an important measure of the value of a food; namely, the quantity of insect life that it can support. The more valuable the product for human food, the more insect life it will support. Whereas highly refined white flour will support almost no insect life, a good product will support a relatively large amount of insect life in proportion to the volume of flour.

Fig. 5.—Best preserved Neanderthal skull; illustrating standards of physical excellence provided by skulls of ancient races of man.

When I was studying this problem in the high Alps in Switzerland, I found an excellent state of physical development and health in adults and children living in all the high valleys. While the summers were short, the rate of plant growth was rapid, and rye was the only cereal that developed well for human food. Herds of cattle pastured near the glaciers. Mountaineer cabins were located near the foot of the glaciers. The children living in these cabins were exceptionally healthy. On the side of the valleys, rye was grown for bread. I obtained a piece of the bread that was made in one of these homes and put it in a bottle and carried it with other foods to my labora-

tory for chemical analysis. It was rich in minerals and vitamins.

In Figure 4, the dish to the left contains all of the residue of that bread after it had been eaten by the bugs which later developed in it. The one at the right shows the quantity of skeletons of bugs that had developed in and lived upon this one small piece of bread. This explained why the human life living upon it was so exceptionally fine. Bugs and children require the same minerals and vitamins. Our modern white bread cannot support much insect life.

This is one of the evils that has accompanied our progress in modernization. We do not realize how much modern human beings are handicapped and injured since they learned how to modify Nature's foods. The wild animal uses Nature's foods as Nature makes them. This was true of the earlier races of mankind. In proportion as man has learned to modify Nature's foods, he has degenerated.

Fig. 6.—Ancient cave man who saw stars that modern man can see only through telescope.

The physical qualities of the Neanderthal man as he inhabited southern Europe are attested by the perfection of his skeleton. In Figure 5, Prof. Sergio Sergi, of Rome University, is shown with what is called the most perfect Neanderthal skull. I visited him in Rome and studied his wonderful collection in 1935. Whereas only four skulls out of 4,000 belonging to the pre-Christian era and gathered from Italy and surroundings islands showed serious malformations, approximately 40 per cent of the skulls in the collection of people who died in the last fifty years showed gross imperfections and abnormal formations. These people had all died in mental institutions.

I have been impressed many times in my studies with the superior physical development and acuteness of the senses of primitive races. This is strikingly illustrated in the visual acuity of the Maori of New Zealand, the Aborigines of Australia and some African tribes. Figure 6 shows a caveman. He did not need a telescope to correctly draw the position of the stars constituting the constellation of Pleiades. Note the accompanying text:

Fig. 7.—Ancient Maori skull, illustrating physical excellence provided by obedience to Nature's laws.

Delighted were archeologists to discover a prehistoric cave-wall painting of the Pleiades star group "Seven Sisters." But surprised were they that the ancient artist painted ten stars, four of which we need telescopes to see. Natural guess: stars were brighter then. Astronomers said "No"—the artist had seen all ten stars with his naked eye. Correct assumption: cave men had better eyesight than modern men.

I was advised that the Australian Aborigines could see a mile away animals which the white man could not see.

It has been my privilege to study the skeletal remains of primitive groups in many parts of the world. I have been continually impressed with the superior qualities exhibited, particularly skull development and design of dental arches.

Fig. 8.—Ancient American husband and wife who lived where food was deficient. His skeleton and teeth are much better than hers. The food was not good enough to protect her against overloads.

Among the skulls of the Maoris of New Zealand, of individuals who lived before the coming of the white man, only one tooth per thousand teeth had been attacked by decay. This is in striking contrast with the condition of the teeth of this same people today since it has become largely modernized by contact with the white population. In my studies of modernized Maori groups, I found from 300 to 600 per thousand teeth attacked by dental caries. This is a typical and striking illustration of modern degeneration. The whites of New Zealand, according to their own dentists, have the poorest teeth in the world today. A typical primitive Maori skull, Figure 7, shows excellent dental arches.

I have recently made a study of pre-Columbian Indian burials in seven of the southeastern states. It has been impressive to see that those groups that lived near the coast and used sea animal-life abundantly, as evidenced from the material found in the burials, had excellent skeletal development, usually with complete freedom from dental caries. This was also true of skeletal material in the interior districts where they used fresh-water clams liberally. In contrast with this, in those areas where they were largely dependent on plant foods and small animals, the skeletal material was fragile and tooth decay often had been extensive. A striking difference in skeletal quality was found. Whereas the skeletons of both men and women were in a state of complete preservation and physical perfection, with little or no caries where sea foods were eaten, those in the interior districts showed a marked difference in quality of the skeletons of adult women and adult men. This is illustrated in Figure 8, which shows what is presumed to be a husband and wife buried together. While his skeleton is well preserved and its structure excellent, most of her teeth had been lost and her bones were of much poorer structure. This may have been due to the overload of pregnancies. This condition did not occur where sea foods were used liberally.

There is a marked tendency in modern civilization to substitute synthetic products for Nature's foods. This has been particularly true of vitamins. While these tendencies are fortunate so far as Nature's requirements can be duplicated, the limited knowledge regarding the number and kind of activators and their individual rôles in conjunction with other necessary activating substances and body building minerals has resulted in serious injuries and some unfortunate misappre-

hensions. For example, it has been assumed that so-called vitamin D as viosterol included much that is required for the control of mineral utilization, particularly calcium and phosphorus.

Since the reduction in skeletal growth constituted the most easily observed deficiency in nutritional interference in infancy as expressed in rickets, the growth process was assumed to adequately express Nature's requirements for mineral utilization. It was early found that exposure of affected infants to ultraviolet light, either from sunlight or from an artificial source, and the use of materials that had been exposed to suitable radiant energy were comparable procedures, since both were effective in preventing rickets. Thus, the activation by irradiation of ergosterol marketed as viosterol or calciferol was supposed to accomplish all that was needed for reinforcing the body enough to maintain normal mineral utilization. A patent was granted covering the entire process of activating drugs and food substances by irradiation. Notwithstanding the fact that I was one of the first, by some considered the first, to report this process, I have never interpreted my data as indicating that irradiation of ergosterol satisfies Nature's requirements. In the first volume of my work on "Dental Infections, Oral and Systemic," published in 1923, page 342, I presented a preliminary report, in a chapter on irradiation. Later, in a paper read before the National Academy of Sciences at Washington, April 27, 1926, I presented further data on the effect of irradiation including the activation of cholesterol by this means.[1]

For nearly two decades, the product activated ergosterol has been accepted as meeting Nature's requirements for mineralization as expressed by a need for vitamin D. Recent studies, however, have shown that Nature's product is not activated ergosterol, now known as vitamin D_2, but activated cholesterol, now known as vitamin D_3. During the years in which activated ergosterol has been used extensively to aid in mineral utilization, many clinical reports have indicated marked inadequacy as expressed by clinical results. Dr. Brehm,[2] for example, has reported that a very large percentage of infants born to mothers that had received activated ergosterol and minerals in tablet form during the gestation period were abnormal at birth, showing such conditions as stone in the kidney and abnormal closure of the sutures of the skull and the fontanel at birth. Calcified islands were also found in the placentae. Several reports have appeared of infants dying soon after birth with gross calcification, including involvement of the coronary artery and myocardium and arteries of other parts of the body.

With the newer knowledge of the determining rôle of nutrition in the development of degenerative diseases, which, according to the data previously quoted, now cause 60 per cent of deaths, it is evident that, in many cases, conditions which do not cause death are primarily vitamin deficiency, including dental caries. The new rôle of nutritional control for disease prevention challenges the attention of the various groups engaged in public health service. Almost weekly, reports appear of additional findings throwing light on the contributing factors in heretofore obscure nutritional diseases.

An important illustration is a report in *Science News Letter* for August 2, 1941, presented under "Medicine" with the following headline: "Cancer Growth Prevented in Mice by Yeast and Vitamins; Vitamins Alone Had Little Effect, but Riboflavin and Pantothenic Acid with Yeast Succeeded with 62%."

These advances in knowledge emphasize the necessity that a change be made from relief of the symptoms of these degenerative diseases by surgery and repair to measures that are adequately conceived and applied for their preven-

tion. While I am not suggesting that a cure for malignancy has been found, data available from several sources indicate that this and other serious disturbances of the digestive tract and associated organs are directly related to nutritional deficiency. In my contacts with government hospitals and medical missions that had been established among primitive races, these diseases were reported to be rarely found among the strictly primitive groups, but to be found in the same stock after they were modernized. Two things are strongly emphasized: the imperative need for substituting prevention for repair, and the need for programs for teaching the public regarding means for prevention.

This at once raises an important question: By what means will the public be informed and who will be their teachers? A report of the survey of the American Dietetic Association made of schools teaching nutrition indicates that of seventy-six medical schools reporting, only twenty had separate courses on nutrition, and of thirty-nine dental schools reporting, only fifteen had separate courses on nutrition. This survey was made in 1939. On this basis, it would seem that we have an explanation for much of the confusion in the minds of the members of the dental and medical professions in this matter of preventive medicine, including dentistry, through nutritional means. There are many reasons why the dentist is the logical person to accept responsibility for the education of the public. He is in a position to see the need, since one of the almost universal maladies of modern man resulting from inadequate nutrition is expressed by dental caries, and because he sees or should see nearly all of the population, beginning in early life.

Dental caries and periodontal disease are expressions of faulty nutrition. Another large group of disturbances will be seen by the dentist if his knowledge includes essential information concerning the need for prevention of prenatal injuries which result from inadequate nutrition of the germ cells of the parents. The latter includes a correct conception of the origin of such deformities as crooked teeth, malformed faces and dental arches and mouth breathing and the significance of brain defects causing abnormal behavior and reduced mental capacity from defects of the parental germ cells. I have reported on this in detail in "Nutrition and Physical Degeneration."

One of the most serious of the present confusions is failure to appreciate that an adequate, well-balanced diet is capable of building people strong and well in all respects and adequate for maintaining health and strength. This is the right of all mankind and their sacred birthright. The primitive races have demonstrated a score of different nutritional formulas, any and all of which will accomplish this. These, when reduced to their bases, are chemically equivalent. The primitives' methods of living give them excellent appetites, enabling them to provide a good factor of safety for the essential minerals and vitamins. While they do not understand the chemical nature of the needed foods, they know and teach the use of the special foods that are needed for providing normal development and continuous health of the various organs and tissues of the body. The Chinese, for example, in a treatise written 1,600 years ago, listed more than sixty foods that were good for eyes, more than twenty of which we now know to be very high in vitamin A, an essential for both the development and the function of the eyes.

The general excuse that the dentist makes is that he is too busy to concern himself with the study of nutritional programs; but this does not answer humanity's needs. The abundance of data available indicating the superiority of the natural foods over modern processed foods compels consideration in human-

ity's behalf that a broader conception of the responsibility of the dentist be accepted.

In the light of this bird's-eye view of modern problems, we find modern civilization condemned to progressive degeneration and final extinction unless means are found for its regeneration through a return to adequate nutritional programs. It is acknowledged that the dentistry of the last hundred years has added almost nothing to the prevention of dental caries and this notwithstanding the fact that the dental branch of the general health service seems clearly to have had the responsibility for leadership in preventive dentistry.

The dentist concerned with prevention will, in his lifetime, receive compensations never experienced by those dentists concerned primarily regarding their opportunity to profit through humanity's misfortune. Only he can know the gratitude of individuals for freedom from pain, incapacity and mutilation for themselves and particularly for their children. He will have the realization that he has made the world a better place to be born in and to live in and has had the opportunity of making himself so nearly indispensable to the welfare of his community that the public will safeguard him from all danger of regimentation. He will have an opportunity to be Nature's helpmate in rescuing degenerating modern civilization, otherwise doomed because of breaking Nature's fundamental laws of life.

We are at the entrance of a great campaign for race betterment, which must change the physical, mental and moral qualities of the race through improved nutrition; first of prospective parents, that they may prepare them for reproduction; second, of the child and adult, that he may keep well after a good start. There will be two conspicuous groups in this work: those who lift and those who lean. It should be expected that the dental profession will change from the latter to the former in this matter. It would indeed be appropriate if the dentist should undertake responsibility for promoting educational programs in grade and high schools and colleges, teaching each generation of pupils to better prepare themselves for their responsibility concerning the unborn generations. There is available for this type of program a vast number of new data including the accumulated wisdom of primitive races. In the fourteen primitive races that I have studied, the incidence of dental caries, for example, averaged approximately one tooth per hundred teeth in isolated groups, but increased to an average of thirty teeth for each hundred teeth for modern groups.

Indeed it would be appropriate for all organized dentistry, through its various branches, to undertake to provide courses of public instruction on the prevention of dental disease, through educational institutions, parent-teacher associations and all uplift organizations. This, the Cleveland Dental Society is undertaking to do with an organized program. Enlightenment of the masses can correct the fallacies regarding both injuries due to faulty nutrition and those handicaps and injuries which formerly were considered due to transfer of faulty hereditary traits, but which, in the new light, have been shown to be due to defects of the germ cells (intercepted heredity) because of vitamin starvation of the parents. Surely no branch of health service has a more golden opportunity for accomplishing race betterment than have the members of the dental profession.

BIBLIOGRAPHY

1. PRICE, W. A.: Calcium Metabolism Studies. *Am. J. Dis. Child.*, 33:78-95, January 1927.

2. BREHM, WALTER: Potential Dangers of Viosterol During Pregnancy with Observations of Calcification of Placentae. *Ohio State M. J.*, 33:990, September 1937.

8926 Euclid Avenue.

ORAL MANIFESTATIONS OF LOCAL AND GENERAL DISEASES

By KURT H. THOMA,* D.M.D., Boston, Mass.

THE horizon of dentistry has broadened greatly in past decades. From a profession chiefly concerned with the care of the teeth, which were cleaned, treated, filled, extracted and replaced, we have developed to the status of a specialty of medicine.

Today, we are first of all concerned in a more extensive field, the health of the entire oral cavity, including the salivary glands. Secondly, we have come to realize that there are no autonomic regions in the body. Any experienced clinician knows that infections do not respect the limits of the field in which they originate, and that oral cancer may metastasize to organs remote from the primary lesion.

The modern investigator has taught us that systemic conditions such as nutritional states, endocrine disturbances and metabolic disorders have important effects on the development of the teeth, and tend to improve or modify the inherent growth pattern of the jaws and faces. In practice, we are utilizing recent knowledge gleaned from the work of researchers to advise our patients regarding conditions which form the background of orthodontic problems and may be expected to inhibit dental caries and periodontal disease.

Finally, we see in the mouth an increasing degree of pathologic change which is a sign of somatic disease, or lesions produced by local infection through the activity of bacteria that have awaited the opportunity to become pathogenic when the soil became receptive. Investigation of these predisposing conditions leads into the domain of internal medicine.

Thus, even diseases that appear to be entirely of local origin often require general medication for effective treatment, to improve the general health of the patient, to correct predisposing causes or to effect a cure through the hematogenous channels; as, for example, with such chemicals as the sulfonamide drugs. In the oral cavity, these act not only by their presence in the tissue fluids, but also through the action of the saliva in which they are contained and which constantly bathes the lesion. General medication by these drugs serves another important function: it prevents bacteremia and the spreading of infection through the circulation when operations such as tooth extraction are performed in infected areas. Thus the finger of progress in dental practice, as well as in clinical and laboratory investigation, points definitely in the direction of medicine.

Oral manifestations of local and general diseases is a timely and important subject, covering a field that is neglected by many general practitioners, and often only because of the more evident or more disturbing problems presented by the patient's teeth. As there is not time to thoroughly discuss oral manifestations of local and general disease, I shall limit myself to a cursory presentation of cases

*Professor of oral surgery and Charles A. Brackett professor of oral pathology, Harvard University.

Read before the Section on Oral Surgery and Medical Relations at the Seventy-Seventh Annual Midwinter Meeting of the Chicago Dental Society, February 18, 1941.

seen in practice or in hospital clinics, hoping to further the recognition and correct diagnosis of both surgical and non-surgical lesions in the mouth. I doubt whether the accepted practice of classifying oral lesions as local or general manifestations is a fortunate one. Division into surgical and non-surgical lesions has greater advantages because it indicates at once that some are treated by the oral surgeon, while others are in the field of oral medicine, and should be treated by the dental internist.

Fig. 1.—Tongue-tie.

Fig. 2.—Mucous cyst of lower lip.

SURGICAL LESIONS OF THE MOUTH

While the surgical operation is distinctly a local method, by which lesions are excised by scalpel or endothermy knife, its effects and complications may be profound and far-reaching. Nor is surgery always successful without correction of somatic conditions, and supportive treatment is, very often, of paramount importance. I need only to mention the recurrence of pregnancy tumors if excised before parturition, and the problems presented by operations on patients suffering from diabetes, avitaminoses and blood diseases. Following are some of the important surgical diseases of the mouth:

Fig. 3.—Epulis granulomatosa arising from extraction socket.

Fig. 4.—Alveolar hyperplasia or epulis fissuratum.

Malformations.—These clefts of the lip, face and palate often present serious problems to the surgeon, while abnormalities of the tongue such as tongue-tie and hypertrophy of the labial frenum are easily corrected. (Fig. 1.)

Abscesses.—These may be due to injury or odontogenic infection.

Cysts.—These lesions occur on the lip and tongue as so-called retention cysts; on the floor of the mouth as ranula, and on the palate as cysts of the papilla palatina. The former are due to the occlusion of the outlets of mucous glands; the latter to the accumulation of secretions in the nasopalatine duct. (Fig. 2.)

Hypertrophy of the Oral Mucosa.—These cases are generally due to mechanical irritation of long standing, presenting the picture of chronic inflammation. We may distinguish several clinical forms:

1. Epulis granulomatosa, which grows

Fig. 5.—Large pregnancy tumor in woman three weeks before parturition.

from extraction wounds and is due to irritation from a spicule of bone or tooth, or which forms a pedunculated area of hyperplasia of the gingiva, often filling the space between decayed adjoining teeth. (Fig. 3.)

2. Palatal hyperplasia, caused by the suction chamber of a denture.

3. Alveolar hyperplasia, the common form resulting from the presence of ill-fitting dentures. (Fig. 4.) From a so-called chronic traumatic ulcer, a fold of tissue forms, often bifid and containing a fissure into which the denture may extend. This very typical lesion is known as epulis fissuratum.

Pregnancy Tumors.—These are another manifestation of hyperplasia which appears in connection with stomatitis gravidarum. (Fig. 5.) They are spherical bodies of deep red or of blue, often attached by a broad pedicle to the gingival papilla. They are generally multiple. They bleed easily when injured

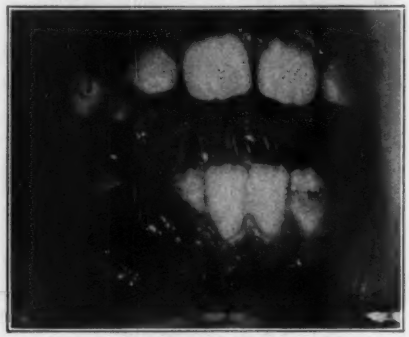


Fig. 6.—Peripheral giant-cell tumor (giant-cell epulis).

Fig. 7.—Fibroma of cheek.

and recur if excised before parturition. They are made up of fibrous tissue with marked angiomatous proliferation (fibro-angioma).

Peripheral Giant-Cell Tumors.—These tumors are seen in hyperparathyroidism, in which we find also the more common type of central lesion. (Fig. 6.) It may be, however, a solitary tumor occurring in an otherwise normal patient. It gen-

erally forms on the gingiva, and for this reason it is also known as giant-cell epulis. It is bluish and, in most instances, is sessile, but may be pedunculated. It shows a tendency to recur if not completely removed. The tissue consists of a synctium of immature connective tissue cells among which are scattered numerous multinucleated foreign body giant cells.

Fibromas.—This typical benign tumor

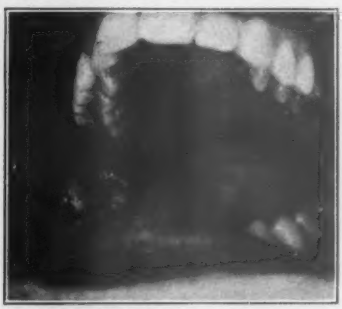


Fig. 8.—Fibrosarcoma of odontogenic origin.

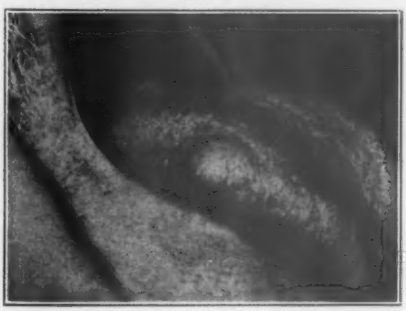


Fig. 9.—Lipoma of tongue.

is of frequent occurrence in the mouth. (Fig. 7.) It forms principally in the fissural area of the mucosa of the cheek, on the tongue and the lip, and sometimes on the gingiva as a soft or hard pedunculated, well-defined growth covered by a pale, smooth epithelium. On the alveolar mucosa, however, it is frequently sessile and may cover a large area. When the entire gingiva is thickened, we may speak of fibromatosis or elephantiasis of the gingiva.

Fibrosarcomas.—This malignant tumor is not infrequently encountered. (Fig. 8.) It is seen in young patients and is apt to recur after excision. It may develop at the angle of the jaw, but also may be seen as an intra-oral lesion which grows rapidly and, when injured by the teeth, tends to ulcerate.

Fig. 10.—Small hemangioma of lip.

Fig. 11.—Hemangioma of tongue of congenital origin.

Lipomas.—Lipoma forms especially in areas where adipose tissue is found. It may be pedunculated or may develop in the areolar gingiva or in the tongue. (Fig. 9.)

Hemangiomas.—Hemangioma is often

of congenital origin, and from insignificant early lesions. (Fig. 10.) Large tumors may develop. (Figs. 11.) The fact that the blood can be temporarily forced out, only to rush back after pressure ceases, is a diagnostic sign. It occurs on the tongue, lip and cheek, and sometimes at the gingival margin.

Endotheliomas and Lymphocytomas.—These neoplasms are quite rare in the mouth. They may occur on the palate. The reticulum cell sarcoma, a form of the malignant lymphocytoma, is made up of large round lymphoid cells with hyperchromatic nuclei and multinucleated cells lying in atypical reticular tissue. Early involvement of the regional lymph glands is a clinical feature. Lymphosarcoma generally forms multiple lesions in the mouth. (Fig. 12.) These tumors resist resection and, after irradiation as well as surgical interference, new tumors arise, and no form of treatment promises permanent benefit.

Fig. 12.—Lymphosarcoma of palate.

Mixed Tumors.—These occur on the hard or soft palate, generally on one side. They are sessile and grow very slowly, but recurrence after operation is quite common because of lack of encapsulation. (Fig. 13.)

Papilloma.—These are soft outgrowths from the surface of the mucosa or may form hard cornified warts by progressive keratosis. (Fig. 14.) The latter occur especially in areas affected by leukoplakia. As cancer may start as a papillomatous lesion, it is good practice to remove papillomas promptly by wide excision, and follow with postoperative irradiation if, on microscopic examination, malignancy is found.

Carcinomas.—Dentists who see patients at short intervals should be able to detect carcinoma early. (Figs. 15, 16.) Since it is impossible to distinguish between benign and malignant growths when small, a biopsy should be performed promptly in all such cases. It must be remembered that the cure of cancer depends on early recognition, and that delay, even of a week, may mean the difference between life and death. Cancers arise from the tongue, lips, palate and alveolar mucosa. When slow growing and bulky, they are radioresistant; when of rapid growth and made up of poorly differentiated cells, they almost melt away when treated by the roentgen method; but because they are also disseminated rapidly, they are liable to recur, and metastasis is often present when the lesion is small. Most oral cancers are of the epidermoid variety, but occasionally a basal-cell carcinoma or adenocarcinoma is seen. The latter are found principally on the palate. Carcinoma grows

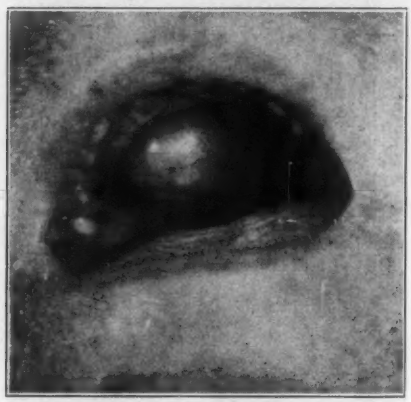


Fig. 13.—Mixed tumor of palate.

without regard to tissue. The jaws may be invaded and destroyed.

NON-SURGICAL LESIONS OF THE MOUTH

The oral mucosa often furnishes important diagnostic information. The membrane of the cheek, the lips, the gingiva and especially the tongue may present symptomatic changes, the correct

Fig. 14.—Papilloma of tongue.

Fig. 15.—Epidermoid carcinoma of lip.

interpretation of which may lead to the discovery of serious somatic diseases. These, in turn, form a background for lesions in the mouth which will stubbornly resist local treatment as long as the metabolic disturbance remains untreated. We may classify oral lesions as oral diseases essentially local in character; general inflammatory diseases; oral disease in blood dyscrasia; those of metabolic origin, and diseases of the salivary glands. Only those of general interest will be considered here.

LESIONS ESSENTIALLY LOCAL

The oral cavity is protected by stratified squamous epithelium, the cells of which have a phagocytic action and are

Fig. 16.—Adenocarcinoma of palate.

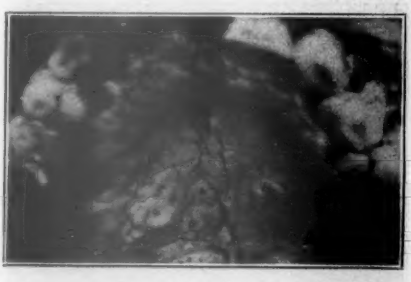


Fig. 17.—Stomatitis nicotina with leukoplakia and cyst formation on the palate.

constantly cast off and renewed. Thus injuries are promptly repaired. Chronic injuries, however, may cause permanent changes. This is typical of the effect of smoking or chewing tobacco; stomatitis nicotina or leukoplakia may result.

Stomatitis Nicotina (Fig. 17).—This entity causes a periodically exfoliating leukoplakia with typical papular nodules

due to the formation of small cysts in the glandular system of the mucosa from occlusion of the outlet of their ducts.

Leukoplakia.—This is another condition that is frequently caused by the use of tobacco. (Fig. 18.) However, it was pointed out by Ullman (1936) that hypercholesteremia is an important predisposing factor in some cases. Vitamin A deficiency and endocrine disturbances are other vital factors that must be considered.

Fig. 18.—Leukoplakia of cheek.

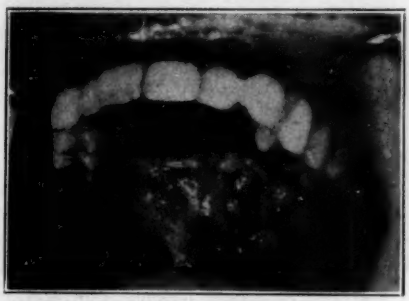


Fig. 19.—Streptococcic stomatitis.

Local Infections.—These produce a simple, membranous or ulcerating stomatitis when due to pyogenic bacteria. (Fig. 19.) As in the case of Vincent's infection, predisposing conditions may play a predominant part. All oral organisms are more pathogenic when the vitality of the tissue is impaired. Debility, fatigue, blood dyscrasia and vitamin deficiencies, especially deficiency of ascorbic acid and nicotinic acid, are important. A correct diagnosis of these underlying factors should be made in order to decide on medication.

GENERAL INFLAMMATORY DISEASES

General inflammatory diseases may be caused by a large variety of conditions. The inflammation intensifies the redness of the mucosa owing to capillary dilation. The mucosa blanches on pressure. If pressure is long continued, exudation may occur, with the formation of vesicles, and later crusting or infection of the desquamated area.

Fig. 20.—Allergic stomatitis (shell fish) with canker sore. The entire mucosa was fiery red.

Fig. 21.—Dilantin hypertrophy.

Allergic Manifestations.—These may be due to contact allergy, such as is seen in denture sore mouth, or to protein

allergy, which may result in urticaria, erythema, angioneurotic edema, erythema multiforme and aphthosis. The ingestion of drugs may have allergic reactions in patients who have a so-called idiosyncrasy. (Fig. 20.)

Stomatitis Medicamentosa.—This may cause eruptions on the skin as well as in the mouth. Phenolphthalein, the barbiturates, iodine and iodoform are some of the frequent offenders. A special form of stomatitis medicamentosa is produced by the use of dilantin sodium, discovered by Merritt and Putnam (1939) and used to control epilepsy. In those who are susceptible, the gingivae become greatly hypertrophied. Gingivectomy affords only a temporary cure. (Fig. 21.) The ingestion of other metals may cause oral symptoms, the use of lead, mercury or bismuth causing typical conditions.

Fig. 22.—Lichen planus of cheek.

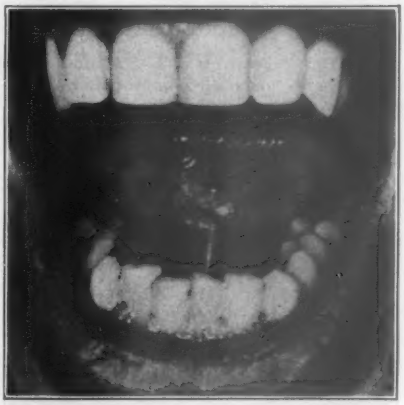


Fig. 23.—Pemphigus.

Lichen Planus.—This disease affecting the skin and mucous membranes perhaps should be included here. (Fig. 22.) It causes nodular patches on the tongue and annular lesions which form a fine or wide meshed lacelike pattern on the mucosa of the cheek and lips.

Fig. 24.—Smooth tongue (Hunter's glossitis) in pernicious anemia.

Fig. 25.—Gingival hypertrophy due to myelogenous leukemia.

Pemphigus.—This is another skin disease of which there are several varieties that may affect the oral cavity. There are cases on record in which the first signs of the disease occurred in the mouth, where bullae from 1 to 10 cm.

in diameter formed in cycles. When these collapse, a foul yellow membrane covers the denuded area. (Fig. 23.)

ORAL LESIONS IN BLOOD DYSCRASIAS

The recognition of blood dyscrasias is important because persons affected are poor surgical risks. They are predisposed to local disease. Very frequently, patients will present oral conditions which

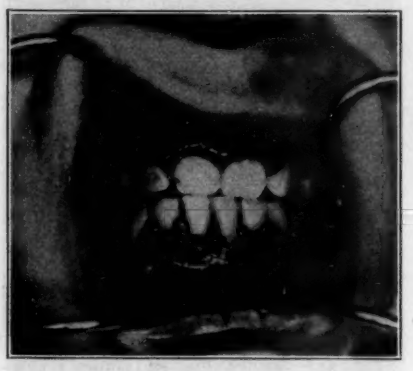


Fig. 26.—Ecchymosis of skin and gingivitis in acute lymphatic leukemia.

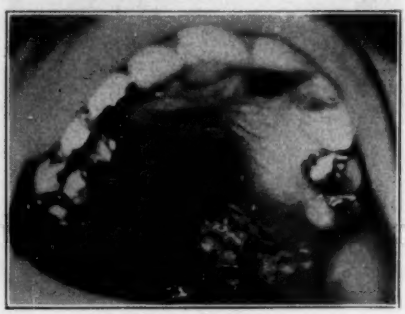


Fig. 27.—Ulcer of palate in agranulocytosis.

may be recognized as symptomatic and give warning that a careful diagnosis should be made.

Hypochromic Anemia.—In this condition, the mucosa is pale and often there are petechiae present, indicating capillary hemorrhage. The bleeding time may be prolonged, even though the clotting time is normal. The tongue may be smooth or may show desquamated areas due to atrophy of the papillae.

Pernicious Anemia.—In this condition, the mucosa appears pale or yellowish and the tongue at first is red, but later becomes smooth from atrophy, which attacks first the sides and later the dorsum of the tongue. The sign is known as

Fig. 28.—Smooth tongue and cheilitis in hypochromic anemia complicated by riboflavin deficiency.

Fig. 29.—Gingivitis dysmenorrhea.

Hunter's glossitis, and there often is a burning sensation associated with it. (Fig. 24.)

Leukemia.—Both myelogenous and lymphatic leukemia frequently cause marked hypertrophy of the gingiva due to invasion of the tissue by leukopoietic

cells. (Fig. 25.) There is, however, a disposition to local infection and ulceration. (Fig. 26.) Evidence of ecchymosis of the skin, as well as in the mouth, is a sign that should be taken as a warning.

Agranulocytosis.—This condition is characterized by fever and an almost complete absence of granular leukocytes. It also predisposes the patient to infection and the formation of ulcers in the mouth. A great number of deaths have been reported, following tooth extraction. (Fig. 27.)

ORAL LESIONS DUE TO METABOLIC DISTURBANCES

The diseases causing the most serious oral disturbances are the vitamin deficiencies, endocrine imbalance, uremia and diabetes.

Fig. 30.—Diabetic gingivitis.

Vitamin Deficiency.—This may have various manifestations in the oral mucosa. It is important to keep in mind that several deficiencies usually exist at the same time, because, in food, the fat-soluble and water-soluble vitamins are closely associated.

Scorbutic Stomatitis.—This condition occurs in ascorbic acid deficiency. Gingival inflammation and hypertrophy are present. The gingivae are blue and there is evidence of ecchymosis. There is a predisposition to hemorrhage and infection.

Vitamin B Deficiency.—This may include a deficiency of thiamine, nicotinic acid and riboflavin. Glossalgia and minor neuralgia of the face are often cured by the administration of thiamine. The beefy tongue and ulcerations due to the presence of Vincent's organisms generally yield to nicotinic acid therapy, while cheilitis fissuratum, so commonly a sign of this deficiency, heals when riboflavin is given to the patient. (Fig. 28.)

Stomatitis Dysmenorrheica.—Various conditions occur periodically in the mouths of those suffering from abnormal or difficult menstruation. These may be due to vaginal absorption or to endocrine dysfunction. We may find inflammation of the gingiva, spontaneous bleeding and often habitual aphthosis. (Fig. 29.)

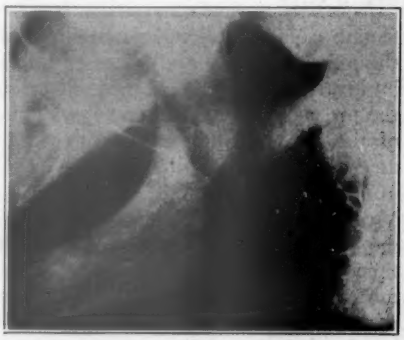


Fig. 31.—Sialogram showing injected duct and peripheral injection of parotid gland. Filling in center indicates tumor formation.

Stomatitis Gravidarum.—This is due to the excess of hormones produced during pregnancy. It has been experimentally produced by Ziskin (1938) by injection of folluetin, and extract of pregnancy urine. The gingivae are hypertrophied and inflamed, and pregnancy tumors may form, as already stated.

Uremic Stomatitis.—This often causes xerostomia. The tongue has a brown coating. The gingivae are edematous and bleed easily, and the breath has a urinous odor.

Diabetic Stomatitis.—In uncontrolled diabetes, gingivitis is present in various degrees of severity, and the deposit of gingival calculus is an outstanding feature. There is lowered resistance of the tissue to infection. (Fig. 30.)

DISEASES OF THE SALIVARY GLANDS

The secretions of the salivary glands are of great importance to the health of the teeth and the oral mucosa. Although we have known for a long time that the constituents of the saliva follow those of the blood, and that certain products and many chemicals ingested are excreted by the salivary glands, we have only recently given attention to the beneficial or the deleterious effects in the mouth of normal or abnormal salivary secretion.

Infection of the Salivary Glands.—Infection causes characteristic swellings of the salivary glands, and is caused either by involvement of the gland itself or by the presence of stones in or by strictures of the ducts. Sialograms are generally used to make a diagnosis.

Tumors of the Salivary Glands.—Various tumors may form. These again are recognized in the sialogram if lipiodol or iodochloral is injected. Tumors are recognized by buckling of the duct, filling defects, bone erosion and localized effusion. (Fig. 31.)

CONCLUSION

I should like to emphasize what I hope the presentation of these cases has brought to light; namely, that the etiology of oral lesions is frequently complicated. No single factor explains any process of life, and the cause of most diseases is made up of a number of factors. One or the other seems to be more important and takes on the character of the exciting cause, but this may be due only to the fact that it is the most obvious factor or the one that is temporarily best understood. Thus, it is all the more important to follow Osler's advice to treat the patient and not the disease. This is timely advice for the man trained in a specialty which is looked on as an autonomic profession; a truth which, when understood, will break down the artificial wall between dentistry and medicine.

BIBLIOGRAPHY

MERRITT, H. H., and PUTNAM, T. J.: Sodium Diphenyl Hydantionate in Treatment of Convulsive Disorders. *J.A.M.A.*, 111:1068, September 17, 1938.

ULLMANN, K.: Ueber Leukoplakia electrogalvanica und hypercholesterinica. *Dermat. Wchnschr.*, 102:425, April 4, 1936.

ZISKIN, D. E.: Effects of Certain Hormones on Gingival and Oral Mucous Membranes. J.A.D.A., 25:422, March 1938.

53 Bay State Road.

HOW VALUABLE ARE YOUR EYES?

By C. W. Adams, D.D.S., San Bernardino, Calif.

SEVERAL years ago, eye strain and the frequent need for a change of optical prescription compelled me to seek a means of conserving my eyesight. I sat down to consider my problem. It became plain that there were three factors involved: first, my eyesight or visual acuity; second, the task to be performed, and, lastly, the light in which I worked. I had recently received competent eye correction. The task I could not change if I wished to continue to practice dentistry. This process of elimination left only the illumination of my operating room to be investigated.

Fortunately, about this time, I heard a representative of the General Electric Company discuss the subject "Lighting for Seeing." This man introduced me to the work of Luckiesh and Moss, two investigators who have laid the groundwork for much of the subsequent research into the problem of illumination. I also learned about the research laboratories of the General Electric Company at Nela Park, Cleveland, Ohio. As a result of hearing an intelligent discussion of the relation of light to seeing, I sent for some pamphlets. A study of this material brought me to the realization that dentists have a real lighting problem. I wish to discuss this problem under three subheads:

A. The fact that a lighting problem does exist in dental operating rooms.

B. An understanding of and a rational attack on the problem.

C. A report of the efforts being made toward solution of the problem.

Read at Pacific Coast Dental Conference, Portland, Ore., July 10, 1941.

The following facts will serve to develop the first subhead; namely, that dentistry has a lighting problem.

1. Man has been on the earth in his present form for at least a half million years. During these years, biologic changes, except for the eyes, have gradually taken place throughout his organism. Let us represent man's life upon the earth by the twelve hours on the face of the clock. On this basis, man began to use his eyes for such tasks as weaving and pottery making just ten minutes ago. Just thirty seconds ago, he began to read. Three seconds ago, he began to practice dentistry. Biologic adaptation could not keep up. Man's eyes have suffered as a result.

2. Nature planned for man to use his eyes for distant seeing, with intermittent application, in abundant outdoor light during a day ending at sunset.

3. Man now uses his eyes for near vision and continuing concentration, with insufficient indoor light, during a prolonged day, frequently ending past midnight.

4. Statistics prove that defective vision prevails in 23 per cent of the population under 20 years of age and increases to 95 per cent among those past 60 years of age. From 27 to 50 years, the most productive period of the dentist, the prevalence of defective vision is roughly 60 per cent.

5. Statistics further prove that eye strain or ocular disease increases according to occupation. In the farmer-laborer group, defective vision varies from 1 to 20 per cent. The machinist-printer group average 50 per cent defective vision;

while in the draftsman-stenographic group, into which the dentist would fall, there is 90 per cent defective vision.

6. The average visual acuity in persons with defective vision is improved 23 per cent by proper eye correction. Increasing only the illumination from a minimum to adequate lighting brings an improvement of 33 per cent; while the addition of glasses and illumination both improves seeing by 56 per cent. The conclusion is that light is a magnifier of small detail. This is of vital importance to the dentist.

9. Scientific measurements prove that 28 per cent less energy is expended in seeing when illumination is increased from a minimum to an adequate level.

10. The eye requires time to adapt itself to light. When the illumination is high, the eyes take snapshots; when the illumination is low, they take time exposures. This has a direct bearing upon productive efficiency. Increasing illumination from 3 to 12 footcandles increased the rate of working in a group with better eyes by 14 per cent and in a group with worse eyes by 22 per cent.

11. A personal investigation of a number of offices of outstanding operators in Southern California showed that these men had lighting equipment which produced as little as 14 footcandles of light, while the average light output at the headrest with all artificial light sources at work was 30 footcandles. This is alarming since careful investigation proves that the average person requires 50 footcandles of light for reading.

Not only was the light value in these offices low, but also the distribution was uneven and was frequently reflected from glaring surfaces as well as surfaces in which yellow predominated, thus destroying any semblance to daylight.

When we understand the preceding facts, we must conclude that the average dentist is trying to apply hard-earned skill to a most exacting task in poorly illuminated rooms. Such a condition leads to impairment of the vision, necessitating the early use of spectacles, which must be changed at frequent intervals. Much energy is wasted, resulting in fatigue, irritability and frequently actual physical discomfort. Tired eyes and a fatigued body are great handicaps. No matter how great the ability of the operator, the quality of his work will be adversely affected by poor illumination.

On the basis of experience, we are warranted in assuming that ten to fifteen years is required to produce a really fine operative dentist. Operative skill so painfully and dearly acquired should be protected and prolonged.

I was invited to present the foregoing problem before the Southern California Chapter of the Illuminating Engineering Society and complied with a short paper setting forth in detail the results of a personal study of more than a year. As a result of that meeting, the illuminating engineers appointed a committee to investigate the problem of dental operating room illumination. The investigations of this group are now in their second year. Dentistry is greatly indebted to these men who are endeavoring to solve one of our greatest problems, and I am particularly indebted to one of their group, Mr. F. C. Leach.

Under the second subhead, I shall now attempt to present the factors involved in the problem, and I shall refer frequently to the report of the Southern California Section of the Illuminating Engineering Society, which appears in the national journal of that society for April 1941, under the title "An Engineering Analysis of Dental Office Lighting." This report is divided into seven main divisions: direction of light and the shadow problem; glare for patient and dentist; footcandles required in the operating field; brightness contrast ratios; general room illumination requirements; color, and a summary.

To discuss at length before a group of dentists the factor of direction of light

and shadow is needless. It is but necessary to state that dentists should prevent shadow as much as possible by proper adjustment of the chair and by proper position of the operator and of his assistant at the chair, thus taking advantage to the fullest of all available light.

We obtain light from three sources:

First, single spotlights, which are of great intensity and directed into the mouth, but which require constant readjustment and create the sharpest and densest shadows. Shadows can be minimized by using a larger reflector area, and shadows can be softened by shielding the top and bottom of the reflector. This softens vertical shadows, but not horizontal ones. The nearer a spotlight is to the work, the less the shadow effects. There are several spotlights on the market embodying the foregoing principles.

Second, multiple source spots, in which the light from one source tends to illuminate the shadows cast by another. Such a system, if fixed, limits the chair positions to a relatively slight possibility of adjustment. The various units, if movable, require too much time for adjustment each time the position of the patient is changed. If set to cover a large area, they lose effectiveness for a given position and become a potential source of glare to patient and operator.

Third, large area sources, which have the advantage of directing light in every direction, thus reducing shadow and thereby permitting lower brightness. Such areas, comparable to a large window, present the difficulty of directing a maximum amount of light toward an operating point. "Large area source" is a relative term, since a source 1 foot square 1 foot from the mouth, produces the same degree of shadow control as a source 4 feet square 2 feet from the mouth. Thus, it is possible to utilize larger areas at a great distance, thereby reducing shadow for more positions of the operating area. Large areas permit the use of the mouth mirror without regard to the direction from which the light is coming—a distinct advantage to dentists. At present, the large area source seems to be the most adaptable to our needs, and it is with the problem of applying this principle that the engineers are now working.

Without going into detail concerning the problem of glare, let us say that glare is a relative term and that each person has his own tolerance range. Glare comes from a source directly in the line of vision of the observer and varies with the size and the brightness of the glare surface.

Some factors to be considered by the dentist in relation to glare are: faulty lighting equipment and reflected glare from adjoining buildings, which may be controlled by Venetian blinds. Glare may also come from high luster walls and woodwork. Another potential source of glare in working with spotlights is the reflection of light which may come from shiny instruments. Satin finished instruments would do much to eliminate this problem. Still another source of glare is the white towels, headdresses and gowns of the operator and his assistant. I shall discuss this later under color.

Glare is an important factor in the lighting problem, and there is ample evidence that it reduces visual efficiency. Roughly, an increase of 10 per cent in glare in one's line of vision may require that the illumination on the viewed object be doubled to obtain the same visibility.

When considering the footcandles required in the operating field, the engineers had the cooperation of thirteen dentists in Los Angeles. The work was carried on in the office of Russell W. Bassett. The engineers acknowledge with gratitude the assistance of Dr. Bassett and the twelve other dentists, who have done much to further this work. I also take this opportunity to thank them for

helping to carry on an important piece of work, which was started by me.

The foregoing group of men chose a standard seeing task in the anterior teeth and one on a lower second molar, and, by standardized means, the engineers measured the amount of light necessary to make this seeing task easy. The results are of sufficient importance that I shall quote verbatim the findings of these tests:

10 per cent of this group can work under less than 150 footcandles.

15 per cent should work with from 150 to 250 footcandles.

30 per cent should work with from 250 to 350 footcandles.

10 per cent require from 350 to 450 footcandles.

10 per cent require from 450 to 650 footcandles.

8 per cent require from 650 to 1,000 footcandles.

8 per cent require from 1,000 to 3,000 footcandles or more.

If this group is at all representative, it is apparent that about 50 to 55 per cent of practicing dentists can get along with 350 footcandles or less for even the most severe seeing task, intensities which are quite feasible without the use of spotlights. The remainder will be forced to use auxiliary lighting for the percentage of their work which constitutes severe seeing tasks. It is apparent that all of a dentist's work need not be done under intensities that are required for critical work. The dentist whose visual acuity is high and who finds that he can do the most critical work under, let us say, 150 footcandles will find 50 footcandles quite satisfactory for the major portion of his work. However, if our group was at all representative, most dentists will require from 100 to 200 footcandles for run-of-the-mill dentistry. Those with known impairment of vision should arrange to have auxiliary lighting of the order indicated for their critical work.

It must be borne in mind that the recommended illumination levels indicated above are minimum values for easy seeing. They are not threshold values of bare visibility. When properly applied, even higher levels may be beneficial. It it evident from these studies that many dentists are operating under mere threshold seeing conditions, placing an abnormally heavy burden on the eyes.

The following observations might be added: First, light values satisfactory for A may not be sufficient for B. Second, light values ample for A at 30 may not be at 40. Third, correction of visual defects by properly prescribed spectacles may reduce the illumination required by some of this group.

In discussing brightness contrast ratios, let us say first that extreme contrast in the brightness of portions of the field of operation makes for more difficult seeing conditions. This condition, which is akin to glare, is particularly annoying when it occurs directly in the central field of vision. For example, when a high-intensity spotlight is directed at the mouth and a portion of the spot strikes the light colored skin of the face or a piece of white cloth, the brightness of the light colored portion is much higher than the brightness of the interior of the mouth. Naturally, the brightness of an object depends upon two facts—the amount of light striking the object and the reflection factor of the object. The mucous membrane of the mouth reflects about 20 per cent of the light striking it. White towels or gowns may reflect as much as 80 per cent of the light. If the same illumination strikes both, the white object will be four times as bright as the darker object. If a spot of light with a sharp cutoff is directed upon a surface, the brightness in the spot may be as much as ten or even fifty times the brightness surrounding the spot.

Extensive data obtained in an investigation of the lighting of hospital operating rooms indicate that allowable bright-

ness ratios for best visual comfort and efficiency are in the range of 3:1 to $\frac{1}{3}$:1. In other words, the object in the central field of vision may be not more than three times as bright as the objects immediately surrounding, and not less than one-third as bright as the surroundings, without causing discomfort to the operator and decrease in seeing effectiveness.

These data indicate the need for further study of means of control of the light, smoothing out the distribution in the field of vision and reducing shadows, and recommend the use of towels and gowns of low reflection. Even the finishes of walls, floors and furnishings have some effect, since they constitute the background against which the dentist sees his work. If walls and floors are either too low or too high in brightness, seeing conditions are not so good as could be desired.

In discussing general room illumination, it becomes necessary to define the term illumination ratio as it applies to the particular problem. It shall be defined as the ratio of the operative field illumination to the general room illumination. This ratio should under no circumstances be more than 5:1. If the footcandles in the operative field which this study shows to be desirable for critical work are to be applied, it is apparent that general room illumination should never be less than 50 footcandles, and, in many cases, may range as high as several hundred, with an average on the order of 100 footcandles. Such levels of general illumination appear to be feasible with direct, semidirect or direct-indirect lighting fixtures. Special designs of these types may furnish the best solution for dental offices, though there are but few commercially available lighting units which would meet these requirements.

Many dentists have had the sad experience of attempting to work with a modern high-intensity spotlight which provided 600 to 800 footcandles in the operative field while the general illumination in the room was as low as 5 to 10 footcandles (a ratio of 80-150:1). It is not surprising that the illumination engineer who is asked to remedy this condition finds that the dentist is experiencing severe eyestrain, loss of time while waiting for eye adaptation to take place and, in many cases, inability to see detail at all unless the work is held in the beam of the spotlight at all times. At a maximum, the eyes cannot accommodate a ratio of more than 36 footcandles of spotlight illumination to 1 of general illumination. The ideal ratio is 5 footcandles of spotlight illumination to one of general illumination. Any adjustment for larger variations in intensity must be made through the nervous system of the observer. When work is carried from a high to a low level of illumination, the eye requires a period of time, often as much as a minute or more, for adaptation in order to see detail. On the other hand, when the work is carried from a low to a high level, although perception of detail may be immediate, it is usually attended by eye discomfort. Such severe demands upon the eye are a source of annoyance and cause fatigue in prolonged work. Certainly, such ratios as those just previously indicated are outside the bounds of reason.

In considering color, let us say that man has become used to daylight for color matching. Therefore, efforts have been made to eliminate some of the excessive reds and yellows of the incandescent lamp. This has been done by use of color correcting filters as applied to the incandescent lamp. The difficulty with this method is that 60 per cent of the light must be absorbed by the filters in an effort to produce accurate daylight color by this means. The bureau of standards has found that 100 footcandles of color corrected incandescent lighting is necessary for accurate color matching. The fluorescent lamp offers a possibility

of obtaining satisfactory daylight color more economically.

A large part of useful illumination is reflected from walls and ceilings. Therefore, the painting scheme in dental offices is important. Regardless of the color of the light source, the net useful light will be seriously affected by color of paints used on reflecting surfaces.

At present, the following general rules will help:

1. If using incandescent illumination, avoid paints containing a predominance of yellow, umber, ocher or other pigments in the yellow or red end of the spectrum. Flat white is preferable for ceilings. For walls, use white with the slightest shade of Prussian blue. The finish should be eggshell.

2. If using fluorescent lighting, especially from daylight lamps, it is best to use very light gray tones. Egg shell finish is again suitable for walls. The ceiling should be flat white.

3. In any case, use pigments for walls having reflection factors of the order of 50 to 60 per cent and for ceilings of at least 75 per cent. Limit darker colors to a small amount of trim, which may also be given a slightly glossy finish.

In closing a consideration of the work of the illuminating engineers, I wish to set forth the requirements to be filled by any lighting system designed for use in a dental operating room. It must:

1. Reduce shadows to a minimum.

2. Maintain glare within known tolerable limits in accordance with the illumination provided in the room generally, and in proper relation to the field of illumination.

3. Provide illumination in the mouth from a vertical or near vertical source of 100 to 200 footcandles, but include an auxiliary source (adjustable and variable) capable of providing from 200 to 1,000 or more footcandles (depending on the visual acuity of the operator). This is demanded for the more critical seeing tasks.

4. Provide the required amount and quality of general room illumination with the proper uniform distribution of light.

5. Provide the proper quality of illumination to facilitate color matching. This must take into account proper color scheme for walls, ceiling and floors.

6. Maintain the brightness ratio within the prescribed limits; that is, 3:1 to $\frac{1}{3}$:1.

The work of this section of the Illuminating Engineering Society is only partly completed. The first year has been devoted to an understanding of our problem. Now the engineers are endeavoring to solve the problem. A large number of lighting systems have been installed in the office of Dr. Bassett. Much has been accomplished. The work is not yet completed. Until it is, let us guard against expensive and unguided experimentation in the field of illumination. Likewise, let us beware of exaggerated claims for lighting equipment presented to us for purchase. Let us apply the yardstick of requirements suggested above. Where possible, let us await the recommendations of this unselfish and commercially disinterested group of men who have attacked one of our major problems.

It is the hope of the dentists who have been engaged in this investigation that the time will come when lighting equipment offered for sale to dentists will be required to meet certain specifications before it can receive the seal of approval of the American Dental Association. This would do much to protect the pocketbook of the dentist, who is continually spending hard-earned dollars for poorly designed and inadequate lighting systems. It would also help to conserve the eyesight of America's dentists.

Finally, let me say that I have just been to the annual meeting of the Southern California Dental Association. During this meeting, I heard the report of the committee of the Southern California chapter of the Illuminating Engineering Society, which has been investigating

dental office lighting. Many new lighting assemblies have been tried out during the second year of their investigations and much progress has been made. This committee is, however, not ready to make any specific recommendations. The report closed with the announcement that the local committee was discontinuing its investigations, but stated that sufficient interest had been created and sufficient progress made to interest the National Association of Illuminating Engineers. The work so admirably advanced locally will be continued by a national committee. We were also told that we might expect, in the not too distant future, to see a manual published as a guide to those who seek to properly illuminate a dental office. Many other professions, trades, mercantile establishments and manufacturers now profit through the use of such a guide.

CORRELATED RADIODONTIC SERVICE IN MEDICAL AND DENTAL PRACTICE

By CLARENCE O. SIMPSON, M.D., D.D.S., St. Louis, Mo.

RADIODONTICS, the art and science of making and interpreting radiographs of the teeth and adjacent structures, should be the principal connecting link between dentistry and medicine, but too often it is the missing link. Twenty-three years of practice limited to radiodontics has included the period when physicians thought that teeth were responsible for most disorders, and the period when most physicians forgot that their patients had teeth. The mean between these extremes is more rational, and surely a physical examination of ailing persons should include the teeth.

Perhaps physicians erred in dismissing dental foci from consideration when they were disappointed in not securing immediate and miraculous cures by the removal of teeth. The practice of medicine cannot always be an exact science of cause and effect, or eradication and cure. Diagnosis and successful treatment are often the result of a process of exclusion and a gradual restoration of vital resistance. Indisputably, chronic infections are deleterious to health, and dental foci are extremely prevalent. With the complement of thirty-two teeth having approximately fifty-two roots, there are fifty-two potential sources of infection and too rarely are they merely potential sources.

Perhaps dentists have erred in minimizing the possibility of a systemic effect of oral sepsis, conserving masticatory function at the risk of impairing more vital functions. Mechanical expediency does not justify the retention of septic teeth, and the absence of local discomfort is not a true test in excluding sources of chronic infection. Instrumental and visual examinations do not suffice for patients referred by physicians for dental consultations. Dentists are primarily concerned with teeth, and physicians are primarily concerned with health, but neither dentists nor physicians should be unconcerned regarding the interdependence of teeth and health.

Physicians generally suspect all

Read at the Pacific Coast Dental Conference, Portland, Ore., July 9, 1941.

crowned teeth and, after the teeth have been radiographed, all pulpless teeth. It is true that after teeth have been repeatedly repaired or have been weakened by caries until they require crown restorations, they are more liable to be septic. However, many normal teeth are crowned for bridge abutments, and some dentists have a fad of crowning teeth which could be restored with fillings or inlays; and so the average crowned tooth is no more to be suspected than are other extensively repaired teeth.

It is also true that pulpless teeth are more liable to be pathogenic than are vital teeth, but there are several reasons why they may not be diseased: 1. A pulpless tooth may not have been invaded by pathogenic bacteria. 2. It may have harbored bacteria which did not survive the environment or were destroyed by instrumentation or antiseptics. 3. The foramina may be imperviously sealed with artificial filling, osteoid tissue, dentin or cementum. Since a pulpless tooth may not be pathogenic, it is quackery to condemn all pulpless teeth.

Alert physicians who realize the possible effects of oral sepsis and are not warped by radical theories prefer to have the dental factor decided by a competent colleague. The competent colleague should be the patient's dentist. But what is the result when the patient is referred to the dentist for an investigation of dental conditions? Too often, the report is "I cleaned the teeth and did not find any cavities"; "The teeth seem to be all right," or "I radiographed the dead teeth and they do not look very bad." Such reports are of no value in health service, and it is not surprising that some intelligent physicians have endeavored to assume the dental problem and have aroused complaints from dentists. In the ensuing disputes, sometimes dentists are correct in objecting to the removal of teeth which physicians condemn, and sometimes physicians are correct in condemning teeth which dentists are nursing for mechanical reasons.

The result is that a few physicians have become arbitrary in dealing with the problem, but most of them have become apathetic regarding oral sepsis. The latter is partly explainable by incorrect procedure, no benefit being derived from removing harmless teeth condemned by physicians, and surely none from retaining septic teeth ignored by dentists. Doubtless, many physicians have gradually concluded that teeth are not an important factor; which is unfortunate for their patients and unfortunate for dentistry.

The focal infection furore caused greater apprehension regarding diseased teeth and created a greater desire for dental service than has all the educational publicity instituted by dentists in a hundred years. That dental deficiency is the most frequent cause for rejection of conscripts and volunteers in the present defense program is not an indictment of the dental profession, but is due to a lack of appreciation of oral hygiene and dental care. Since we must maintain appreciation of dentistry to have the opportunity of rendering full service, it is a serious mistake to lose the most potential educational influence by our lack of cooperation. It may have seemed clever to say that physicians had a hobby of blaming everything on teeth; or, if physicians think teeth are so important, why do they not have something done with their own; or relating the uproarious incident of the patient with only artificial dentures who was advised by a physician to have an x-ray examination of his teeth.

Instead of resenting the suspicions of physicians that the teeth are contributing to illness, a dentist should welcome the suggestion, admit the possibility and assume his responsibility by making a thorough clinical and radiographic examination. The radiographic evidence should be reliable as a basis for his decision and for reference to any consult-

ant. A dentist should not demur at condemning teeth which are evident sources of infection, even though the condition is the result of his operations. It is not a disgrace to say: "I have done everything that I can do to save these teeth, but the result is unsatisfactory. If these teeth had been treated sooner, this condition could have been prevented."

This is a vigorous argument for conservative dental service presented at the psychologic time to impress the patient. Every one is most receptive to advice regarding prophylactic measures and repair at the time of a dental disturbance, and most amenable to suggestions for replacements at the time teeth are lost. Yet dentists often neglect to recognize and to take advantage of such opportunities. Most persons defer and evade dental care and, for their welfare, we must utilize applied psychology to secure active interest. All successful sales or service promotion is accomplished by creating or stimulating desire. If it were not for pain and vanity, there would not be half the present desire for dental care, yet dentists have opposed physicians promoting for dentistry one of the dominant human desires—that for health.

Many dentists would argue that they cannot confer with physicians who know so little about dentistry, and that the fault is with physicians in exceeding the limits of their field. However, there is a way for dentists to cooperate for the welfare of all concerned. We must have a broad conception of oral sepsis and its systemic manifestations. We must be able either to produce or to procure reliable radiographic evidence and to interpret it intelligently. We should supply physicians with a verbal or a written report of the pathologic findings, and the probable significance of them, and recommend procedures for correction subject to consultation regarding the condition of patients and the choice of conservative or radical treatment.

These qualifications entail more exacting requirements of radiodontic practice than the usual standard. The radiographs must reveal images of the minimum distortion and superimposition, sharp definition, moderate contrast and density and different aspects. These are not meaningless words, to be forgotten, but they demand that each technical factor used in producing radiographs be mastered by systematic training as offered in the limited attendance clinics. The clinical examination should determine the condition of the soft tissues and supply the available information to verify, modify or contradict the radiographic evidence. The interpretation must specify the evidently pathogenic teeth and septic foci, with mention of any questionable findings which have not been excluded as sources of disturbance. The report should recommend the necessary operations to eradicate oral sepsis, with due regard for conservation of masticatory function and optional methods in dealing with questionable conditions.

In determining oral sepsis, a distinction must be made between pathogenic teeth and merely pulpless teeth. The fallacious opinion that since some pulpless teeth are sources of infection, all pulpless teeth are pathogenic has been given much publicity, but it is not sound. That pulpless teeth may not be infectious is established by the presence of approximately normal periapical structures, as these are the first affected by bacteria or bacterial toxins emanating from teeth. Therefore, all pulpless teeth should not be condemned, and some with bone involvement may be successfully treated when conditions justify this procedure.

In searching for pathogenic teeth, critical inspection must be made for septic degeneration of pulps which may respond to vitality tests. The process of degeneration may extend over several months, but when the pulp becomes septic, the characteristic periapical changes soon occur. These are distention

of the lamina dura and thickening of the periodontal membrane around the apical third of the root. Septic pulps retaining circulatory connection are liable to be more virulent than are most pulpless teeth, but conservative treatment is more favorable in this stage than when there is extensive bone destruction.

A survey of oral sepsis must include gingival pockets resulting from pyorrhea alveolaris, and those around partially erupted third molars, and septic crypts persisting in edentulous alveolar process. Periodontal pockets surrounded by an abundant capillary and lymphatic circulation are prevalent septic foci, which are ignored by most physicians and most dentists. A false belief exists rather generally that because periodontal pockets drain occasionally, their presence is not so great a menace as are periapical bone involvements. However, the drainage occurs only from pressure, either spontaneous or external, and is never thorough. Sixteen strains of bacteria, including *Streptococcus viridans,* were isolated from periodontal pockets by Read; which surely establishes these lesions as seats of chronic infection. When the support of teeth is hopelessly impaired, they should be removed, and periodontal pockets around other teeth should be eradicated.

Contrary to prevailing opinion, pericoronal crypts incident to partially erupted mandibular third molars are often symptomless seats of continuous suppuration and alveolar destruction. Unless an acute exacerbation demands attention, they smolder unsuspected until they are discovered radiographically. When the retention of third molars is indicated and there is a prospect of their being functional, the crypts should be eliminated by irrigation and medication, or excision. Otherwise, the affected third molars should be removed.

There are not so many septic crypts in edentulous alveolar process as "residual infection" fanatics imagine. When the source of alveolar infection is removed, repair usually occurs, but the density and pattern of the regenerated bone are often not identical with those of the surrounding bone. A septic crypt appears similar to an area of periapical destruction and should be curetted, but mere areas of radiolucency in thin irregularly calcified alveolar process should be correctly identified and left undisturbed.

Calcareous deposits on teeth should be mentioned because they are inimical to oral health and explain gingival inflammation, which may be noted by physicians. Caries should be reported because it endangers pulps and may be responsible for trigeminal pain. Needed restorations and replacements to improve masticatory function should be advised, so that physicians may know of the deficiency in relation to digestive disorders. All this essential information can be presented concisely by applying critical thought to the arrangement and construction. Modern physicians compile extensive histories of their patients and will welcome the dental addition.

What are the advantages of this cooperation? First, it provides better service to patients. Most persons have dental and oral disease which would be neglected indefinitely unless physicians demanded investigation, and this applies to many persons who have alleged service by dentists possessing x-ray machines. A thorough examination including radiodontic evidence promotes correct diagnosis and effective treatment, which are expected of physicians, but are not always rendered when oral inspection is limited to a glance at the tongue. The eradication of oral sepsis would benefit many persons more than other treatment has done. Physicians do not ignore continuous suppuration and tissue destruction elsewhere, as they do in the alveolar processes.

Secondly, dental cooperation aids physicians by eliminating primary or

contributory factors in metastatic and systemic disturbances and by increasing physiologic resistance, which promotes the cure of any disease. Physicians are not familiar with the details of dentistry and need to have the responsibility of oral health assumed by dentists. Chronic dental infections are usually hidden and painless, and can be revealed only by thorough radiodontic examinations. Unless these examinations are made, physicians must guess at or ignore dental conditions; which is not conducive to successful treatment.

Thirdly, medical cooperation is of tremendous advantage to dentists in suggesting the danger of oral sepsis and the importance of dentistry. Most persons have implicit confidence in the advice of their physicians, and when that advice is for dental investigation, there are extraordinary opportunities for dentists to render service. Under these conditions, patients want dental infection eliminated, replacements made and preventive treatment applied. Instead of dentists urging indifferent patients to have the necessary operations performed, there are interested patients requesting the necessary service. Dentists must then fulfil their obligations, by making adequate radiodontic examinations, interpreting the evidence correctly and performing the required operations efficiently.

The greatest opportunity to establish dentistry as an essential factor in maintaining and regaining health has been lost, but that desirable status can be gradually regained. Physicians attempted to include dentistry in medical practice and were stubbornly opposed. The campaign to coordinate medical and dental practice must now originate with the dentist, who should neglect no occasion to emphasize health service. Dentists not only must fully cooperate, but also must take the initiative in retrieving the active support of physicians. When oral sepsis is eradicated or masticatory efficiency is increased, inquiry should be made as to whether the patient is under medical treatment, and, if he is, the name of the attending physician. Then the physician should be informed of the correction of dental conditions to demonstrate cooperative intentions and to secure recognition of the dental factor in treatment. Rebuffs should not discourage this procedure, and a response from the physician that the teeth are unlikely to have any relation to the patient's ailment should be countered with the statement, "The dental treatment will be beneficial and I hope it will assist you in restoring the patient's health." Remember that physicians have become disinterested in dental problems and need vigorous reminders that impaired function or disease in any part may affect the entire body, and that the mouth is a susceptible part. It is the duty of every dentist to extend the benefits of dentistry to the utmost, which cannot be done without the correlation of radiodontic service in medical and dental practice.

University Club Bldg.

BACTERICIDAL EFFECTS OF SOME DRUGS USED IN PULP CANAL THERAPY

By JOHN R. PEAR,* M.S., D.D.S., Detroit, Mich.

THE question of the pulpless tooth is one that all of us would prefer not to deal with. Preventive dentistry has done a great deal to eliminate much of the need for pulp canal therapy, but the day of no pulpless teeth is still far in the future.

Many drugs have been used for the treatment of pulpless teeth, in an effort to sterilize the pulp canals. Some have great germicidal power only when in contact with the tissues. Others are too caustic when in contact with the tissues. Some do not retain their antiseptic properties long enough and require too frequent treatment changes; etc.

The object of the experiments here described was to determine whether any drug or combination of drugs used in these experiments and in pulp canal therapy would aid in sterilizing pulp canals without actually coming in contact with the organisms. Much literature has been circulated regarding the phenol coefficient of this or that drug, but, from a clinical viewpoint, there are many other requirements to be taken into consideration when a drug is used in pulp canal therapy. Some of them are as follows:

1. The agent should retain its germicidal effect for from forty-eight to sixty hours when sealed in the tooth.

2. It should sterilize without irritation.

3. It should sterilize without surface contact with the organism.

4. Its germicidal vapors should be eliminated slowly to establish and maintain sterility, and to avoid the daily change of applications.

5. It must give off germicidal vapors at body temperature.

The drugs used in these experiments were: azochloramide; merthiolate, sol. 1-1000, stainless; liquid phenol, U. S. P.; mercresin tincture; Kerr's tri-chlor; camphorated monochlorophenol; formocresol; suldox, and eugenol.

The camphorated monochlorophenol used was that employed in the clinic in the School of Dentistry, University of Detroit. It is made by placing equal parts by weight of gum camphor and paramonochlorophenol together in a bottle and allowing the mixture to stand. After a short time, the two solids become a liquid and they remain liquefied. Prinz has a formula for camphorated monochlorophenol, two parts of gum camphor and one part of paramonochlorophenol. Kerr's tri-chlor contains chloramine T,

EFFECT ON BACTERIAL GROWTH OF VAPORS FROM VARIOUS DRUGS

Drug Used	Cases of No Growth	Cases of Some Growth	Cases of Full Growth
Eugenol	4	44	0
Mercresin	0	15	33
Formocresol	48	0	0
Camphorated monochlorophenol	46	1	1
Merthiolate	43	5	
Phenol	39	9	0
Tri-chlor	0	25	23
Azochloramid	0	8	40
Suldox	0		48

*Assistant professor of pharmacology, University of Detroit.

sodium hypochlorite, sodium carbonate and sodium chloride. The only advantage of this over chloramine T is the fact that it is more stable and it may liberate chlorine a little more slowly.

A *Staphylococcus aureus* and also a mixed suspension were used to inoculate the medium. The mixed suspension was made from a 36-hour culture, the material coming from a putrescent pulp canal, the purpose being to approximate a condition found in an infected pulp canal. There was no difference in the results obtained in regard to which suspension the medium was streaked with. Agar and blood-agar plates were used as the medium. The procedure was as follows:

The plates were streaked several times with a platinum loupe dipped in the suspension. Filter paper was placed in the top of the petri dishes, and 4 drops of the drug being tested were dropped on the filter paper. The two parts of the petri dishes were then fitted together with the top side down, to prevent any of the drug from coming in contact with the streaked medium. This meant that the only possible means of preventing growth was by the vapors given off at body temperature. The plates were sealed with parawax paper. Several control plates were run. They were incubated at 37 C. Growth records were taken in twenty-four hours, and growth records and photographs in forty-eight hours. The object of sealing the plates was to have the experiment simulate as nearly as possible treatment of a tooth.

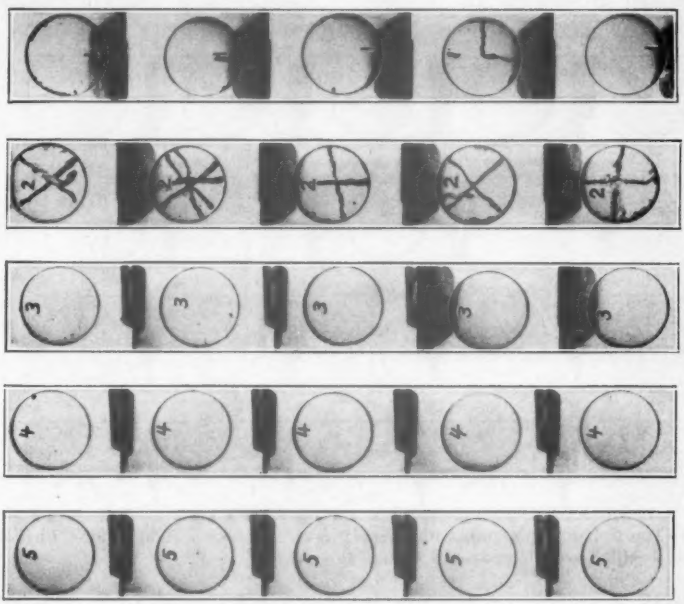


Fig. 1.—Top to bottom: Results with eugenol; mercresin; formocresol; camphorated monochlorophenol; merthiolate. Eugenol showed some growth on all plates; mercresin, no retarding of growth on any; formocresol, camphorated monochlorophenol and merthiolate, no growth.

The results are shown in the table. Formocresol proved the most efficient drug, camphorated monochlorophenol next and merthiolate third. It will also

be noted that phenol alone was effective. Eugenol showed a marked ability to retard bacterial growth. Tri-chlor, mercresin, suldox and azochloramid were relatively ineffective, as shown in the table. The inhibition of bacterial growth was due entirely to the vapors, or gases, given off at body temperature, as none of these drugs came in direct contact with the medium or the organism.

A portion of the photographs taken are shown in Figures 1 and 2. Eugenol shows some growth on all plates and mercresin full growth on all. Formocresol shows no growth on any plates putrescent pulps. It has been by far the most satisfactory drug used for this purpose. We have sometimes sealed in formocresol for the first treatment of putrescent pulps, but have believed it rather irritating when sealed in the apical third, except when it was extremely difficult to stop seepage in a chronically abscessed tooth. In these cases, formocresol was sealed in for twenty-four hours with beneficial results, and treatment continued with camphorated monochlorophenol.

Camphorated monochlorophenol was sealed in as shown in Figure 3: A dry

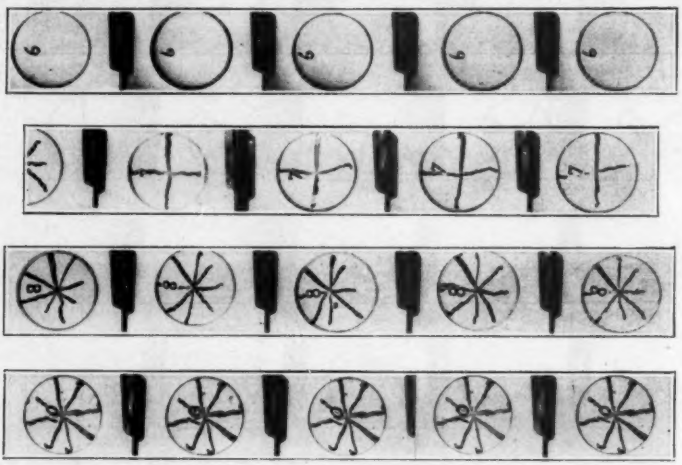


Fig. 2.—Top to bottom: Results with phenol; tri-chlor; azochloramid; suldox. Phenol showed no growth; tri-chlor, azochloramid and suldox, no growth.

and camphorated monochlorophenol no growth. Merthiolate shows no growth on any of the plates. Phenol shows no growth, and tri-chlor, azochloramid and suldox show almost no retardation of growth.

In the dental infirmary of the University of Detroit, we have used camphorated monochlorophenol over a period of six years in the treatment of several hundred pulpless teeth. It was used after removal of the pulp from vital teeth and also in the treatment of paper point, with the sharp end clipped off to prevent its extending through the foramen, was placed in the tooth. A very small paper pellet was dipped in the camphorated monochlorophenol and placed in the tooth on the paper point. The amount of the drug on the point was just what it absorbed from the small pellet. The tooth was sealed first with temporary stopping, which, in turn, was covered with temporary cement. We have several cases in the infirmary in which treatment had progressed to where

successive negative cultures were obtained and then the patients failed to return for two or three months. The patients reported that they had no discomfort. We cultured these teeth and invariably found them negative. Patients have reported back with the tooth tender because of overinstrumentation. Camphorated monochlorophenol was sealed in again as above and the patient was dismissed, to return in two or three days. On returning, he reported all soreness gone.

Merthiolate has been used in a few cases with excellent results. The teeth remained comfortable and negative results were obtained in all cases in which it was used. It was used only in teeth that were to be restored by a Davis or jacket crown. Mercury compounds have a tendency to discolor, but, at the present time, I am not prepared to make a statement about the possibility of discoloration by merthiolate.

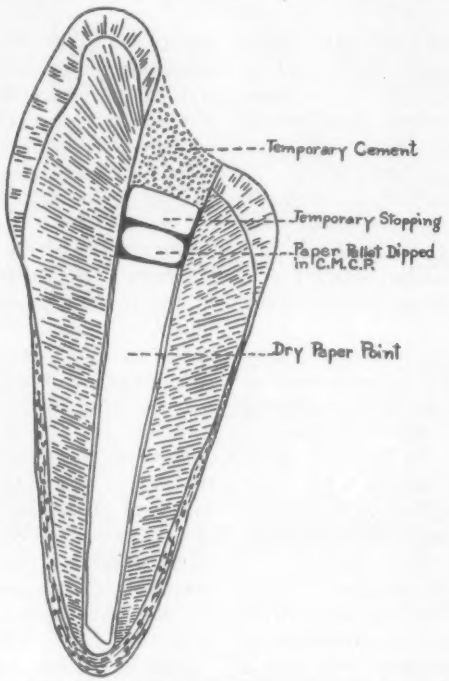


Fig. 3.—Manner of sealing in camphorated monochlorophenol.

CONCLUSION

1. Formocresol and camphorated monochlorophenol were the most efficient drugs used in the experiments.

2. Large amounts of these drugs are not necessary in the treatment of pulpless teeth and should not be used as results can be obtained with small amounts.

3. Camphorated monochlorophenol was the drug of choice for the treatment of pulpless teeth. If used properly, it is non-irritating and an effective bactericidal agent.

4. Drugs that show bactericidal action at body temperature by liberating gases or vapors and do not irritate the tissues are preferable to drugs that must con-

tact the organisms to be effective. It seems that they would also be more efficient in sterilizing lateral canals and periapical tissue.

5. More data on merthiolate are necessary. At present, it seems to have many desirable qualities and no undesirable effects.

BILATERAL CLEFT-LIP RECONSTRUCTION

By LOUIS W. SCHULTZ, D.D.S., B.S., M.D., F.A.C.S., Chicago, Ill.

NOT being satisfied with the results of most bilateral cleft-lip operations performed by various other operators and by myself, I diligently searched for a method which would produce a more nearly perfect lip.

Having tried many of the methods described in the literature with poor results, I welcomed the technic which I finally developed and by which I can produce a much better lip in 98 per cent of bilateral clefts.

The first prerequisite is a large volume of cases. The second is best expressed by the phraseology used by the late Truman W. Brophy when he said: "All the normal parts are there. All you have to do is unite them." No truer words were ever spoken when applied, as he applied them, to the reconstruction of cleft lips and palates.

The transitional stages from the old classical Brophy technic to the method I have now developed are evidenced by the cases I have operated upon over a period of sixteen years.

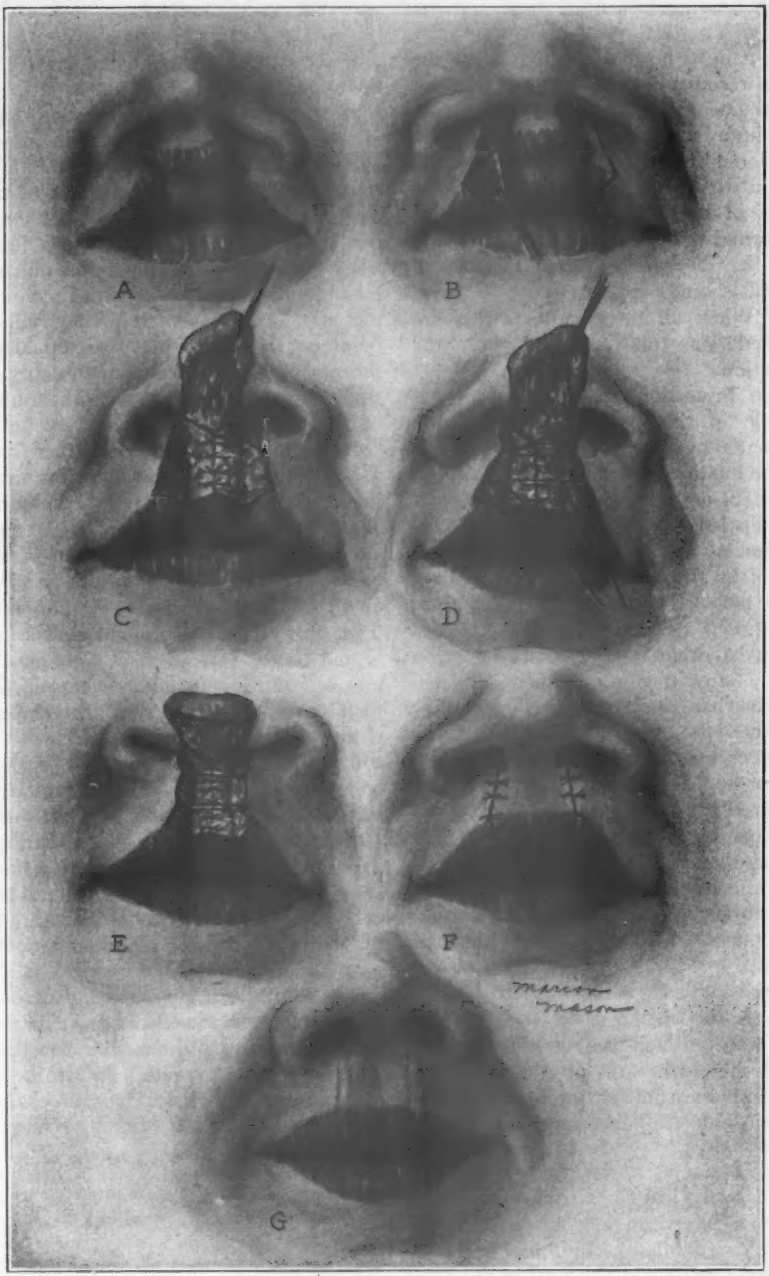
This operation, being one of choice, should be performed when the baby is in the best physical condition. Obviously, neither immediate repair after birth nor postponement of the operation for several years is correct from the standpoint of selection of time. Surgical procedures performed immediately after birth involve an unnecessary risk, for the parts are tiny and friable, and this increases the chance of a poor result. Also, I feel better satisfied if the physical condition has been checked, the size and position of the thymus gland have been ascertained, a normal dietary program has been established and the baby has been found free of other serious congenital defects, before I begin any surgical corrections.

However, to defer the operation until the baby is several years old is also poor judgment, in my opinion. The humiliation experienced by the parents and other members of the family can be avoided by early operation, and the benefits that come from an early molding of these parts can be obtained.

The ideal time for reconstructing a bilateral cleft-lip depends, in my opinion, on the amount of displacement of the intermaxillary bone. If this segment is in normal position, closure of the lip can be performed as soon after the check-up mentioned above as the baby is found in fit condition for operation. If, however, this bony segment is out on the tip of the nose, attached to the end of the vomer and not attached to the lateral maxillary segments, it is necessary to

From the Department of Surgery, University of Illinois, College of Medicine and College of Dentistry.

Read before the Section on Oral Surgery and Medical Relations at the Seventy-Seventh Annual Midwinter Meeting of the Chicago Dental Society, February 18, 1941.



A, bilateral cleft-lip untouched; B, initial incisions for preparation of flap; C, suturing flap to close lingual surface of lip; D, buried catgut sutures to narrow skin margins relieving tension on suture line; E, central bud of lip tissue ready to be sutured in its new bed; F, central bud of lip tissue sutured in place; G, end-result.

place it in its normal position before the lip is reconstructed. The reduction of this segment should be the first stage; the closure of the lip, the second, and that should be done at a later date. The correct time for operation may be 3 weeks of age. The baby should show a normal gain in weight, indicating that the diet agrees with it, and, all in all, should appear to be a good risk. When all these requirements are fulfilled, one may proceed with the operation.

The illustration presents the steps and technic in this type of reconstruction originated by me.

The incisions are made so that all vermilion tissue is saved. The normal vertical lip length is that which closely approximates the length of the skin of the bud of lip tissue overlying the intermaxillary bone. This small portion of skin and muscle develops to double or even treble its original size, sometimes very shortly after it is placed in its normal position between the lateral segments; for then the muscle tension exerts its influence on this highly important portion of lip. The lateral lip segments are prepared by starting an incision high in the floor or even in the lateral wall of the nose, and carrying it down to a predetermined point on the skin at the mucocutaneous junction. From this point, it is extended medially half way through the flap.

This incision is carried half way through the thickness of the lip and half way through the vermilion tissue which shows when the lip is at rest. This flap and one similarly prepared on the opposite side are joined later to form the anterior portion of the lingual surface of the upper lip.

In the preparation of the central bud, all vermilion tissue up to its attachment to the gum is conserved. The incision is started high in the medial aspect of the nose and carried down to a predetermined point at the mucocutaneous junction; then around through the mucous membrane, following its attachment to the maxilla to a second predetermined point on the other side, then up along the mucocutaneous junction similarly to the incision which starts the preparation of this bud.

Now the central flap is dissected from the bone until it fills perfectly the missing skin, muscle and mucous membrane, to give proper contour, thickness, length and width, and is turned up out of the way. The lateral flaps are turned lingually and united in the median line. The central flap is brought down and united with lateral flaps—muscle to muscle, mucous membrane to mucous membrane and skin to skin. Interrupted chromic oo catgut sutures are used for the muscles, and interrupted dermal oooo or 6 o for the skin and mucous membrane. Nostrils should be left open, and the wound is to be kept clean and dry, being cleansed with saturated boric acid solution and cotton applicators when necessary. The Logan lip bow can be used to advantage to relieve tension on suture lines.

The result is an abundance of mucous membrane to fill the central space formed by the dissection of the median flap from the bone. Thus, a perfect lip results, including the cupid's bow.

25 East Washington St.

INLAY PATTERNS BY THE WAX GUN TECHNIC, WITH OBSERVATIONS ON PHYSICAL CHANGES IN WAXES

By W. L. Wylie,* B.S., D.D.S., Cleveland, Ohio

RECENT studies of the physical properties of waxes, investments and other materials related to the casting process have resulted in changes in technic contributing toward perfection of the gold inlay. However, so much attention has been focused on the importance of physical changes that some operators are perhaps inclined to associate their failures with such phenomena to the exclusion of other factors involved.

Failure of an inlay may result from an improper preparation of the cavity, unsatisfactory wax reproduction of the portion of the tooth lost, incomplete casting, incomplete cementation or failure to keep the preparation dry while setting the inlay, to say nothing of failure of other technical procedures equally important and resting entirely with the operator.

Of all the factors within the control of the operator, none is likely to be more variable or more related to the character of the inlay than that associated with the manipulation of the wax from which the pattern is made. Open gingival margins, as frequently seen, are due in large measure to inaccurate and incomplete patterns, resulting in failure of the wax to reach all parts of the prepared cavity. No casting can be more accurate than the pattern from which it is reproduced.

Of the two methods employed in making wax patterns, the direct and the indirect, it is generally conceded that the former offers assurance of more satisfactory final results, provided it can be used advantageously. The chance of error is less because the number of steps between the production of the pattern and finishing the inlay have been reduced to a minimum.

Various ideas prevail as to the best procedure to be followed in constructing a direct wax pattern. Some operators find that, in their hands, the wax can best be brought into its proper working range by slow and careful heating over the flame. Others employ the water bath at a given temperature for this purpose; while many insist that satisfactory results can be obtained only when the wax is brought to the right consistency in a constant temperature oven. While most direct patterns are made without the rubber dam, there are operators who insist that the maintenance of a dry preparation properly lubricated is essential to accurate reproduction of the portion of the tooth to be restored. Some operators employ a matrix; others do not. A successful end-result seems to depend more on a mastery of the particular technic employed than on the method itself.

Whatever the method used, results

Read before the Section on Operative Dentistry at the Seventy-Seventh Annual Midwinter Meeting of the Chicago Dental Society, February 18, 1941.

*Dean and professor of operative dentistry, School of Dentistry, Western Reserve University.

are likely to be uniformly good as long as the preparation involves not more than two surfaces of the tooth. When three or more surfaces are involved, the procedure of making the pattern becomes complicated because of the difficulty of copying accurately in the wax the two or more gingival regions. The completion of patterns that are inaccurate in this respect is frequently and satisfactorily effected by rebasing with a wax of lower melting temperature than that used in the bulk of the pattern.

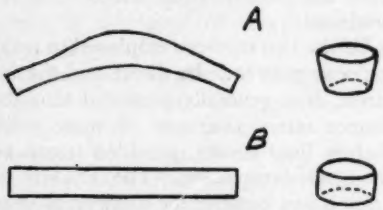


Fig. 1.—A, matrix of type to be used in making wax pattern. B, cylindrical matrix resulting from use of straight band, which will not permit restoration of correct proximal contour.

Fig. 2.—Inlay to be placed in upper first molar, both proximal surfaces of which are carious.

A method of securing a pattern accurate in all details is presented herewith, a modification of that described by F. T. Armstrong,[1] the wax gun technic. The method differs essentially from that of Dr. Armstrong in that a matrix is employed. Failure to use a matrix, regardless of the method followed, is likely to result in an inaccurate reproduction of the gingival margins, while removal of excess wax in this region may be accompanied by distortion of the pattern.

The wax gun technic, with the use of the matrix, not only gives assurance of accurate gingival adaptation, but also subjects the pattern to a minimum liability of distortion through carving the proximal portions of the pattern to correct form.

While any of the patent devices designed to hold a matrix in position for amalgam may be used for the same pur-

Fig. 3.—Occlusal impression tray together with other equipment used in technic described. The slotted sprue base is to be noted.

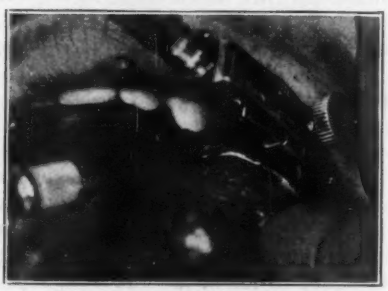


Fig. 4.—Occlusal impression.

pose in making a wax pattern, the matrix itself must be different. A matrix that is in general parallel with the axial surfaces of the tooth will give sufficiently under the pressure of packing amalgam to make possible a restoration of normal contour. Sufficient pressure cannot be applied to inlay wax to effect a similar result in the finished pattern. It is therefore necessary to cut the matrix so that.

when it is placed on the tooth, it will constitute the frustum of a cone with the smaller base directed toward the gingival portion of the tooth. Such a matrix will permit full restoration of proximal contour and allow the wax to extend slightly over the buccal, lingual and gingival margins because of freedom from impingement of the matrix on these margins. The operator should cut his own matrix, using stainless steel of 1-2,000 gage. Correct and incorrect patterns for a matrix are shown in Figure 1.

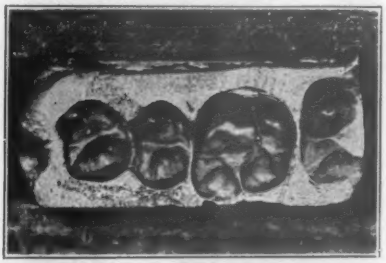


Fig. 5.—Trimmed impression.

Fig. 6.—Completed cavity.

The technic about to be described is intended for use in restoring a tooth the occlusal surface of which is sufficiently intact that it may be copied with a fair degree of accuracy in the finished restoration. If this surface is affected by decay, it should be temporarily restored by means of cement or guttapercha. The tooth selected for purposes of illustration, an upper left first molar, was affected principally on the proximal surfaces and needed no preliminary occlusal treatment. (Fig. 2.)

A matrix conforming to the description given under A, Figure 1, and trimmed to approximately two-thirds of the length of the crown is prepared for use on the tooth in which the cavity is to be prepared. An impression tray is made from an aluminum receptacle such as is customarily used by manufacturers in mounting artificial teeth. Part of the buccal flange of the tray is removed so as not to interfere with the matrix holder. (Fig. 3.)

Fig. 7.—Monson compound heater.

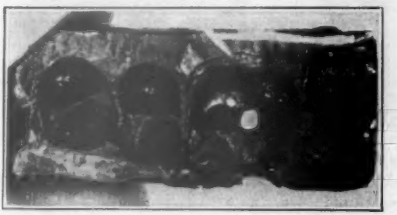


Fig. 8.—Impression with hole for tip of gun.

Since the rubber dam is to be used, the clamp is placed in position on the upper second molar so that an occlusal impression may be taken without conflict of the impression tray with the clamp. Modeling compound is seared to the tray and compound added to assure an impression of the occlusal third of the first molar along with a similar impression of the proximal teeth. The compound is tempered in a bath of suitable temperature and carried to position in the mouth. (Fig. 4.)

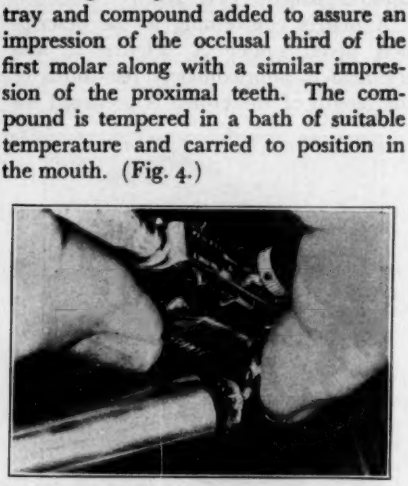


Fig. 9.—Wax being injected into prepared cavity.

Fig. 10.—Pattern as it appears after removal of impression. The matrix is still in position.

After the impression has been chilled, it is removed from the mouth, the excess compound is removed from the buccal and lingual surfaces and the occlusal surface is trimmed so as to barely leave the marking of the matrix. (Fig. 5.) The matrix and clamp are then removed and steps taken to prepare the cavity.

The final details of cavity preparation and the procedures associated with making the pattern are carried out with the rubber dam in position. A dry field contributes to accuracy of results in both steps. The use of the dam, however, is no more necessary in employing this particular technic than in any other. If the dam is to be employed, some type of lubricant must be used to facilitate removal of the pattern. For this purpose, J. R. Yant suggests a solution of approximately 1 part of cocoa butter to 5 parts of chloroform. The application of this solution is followed by immediate evaporation of the chloroform, leaving a thin film of cocoa butter on the walls of the prepared cavity.

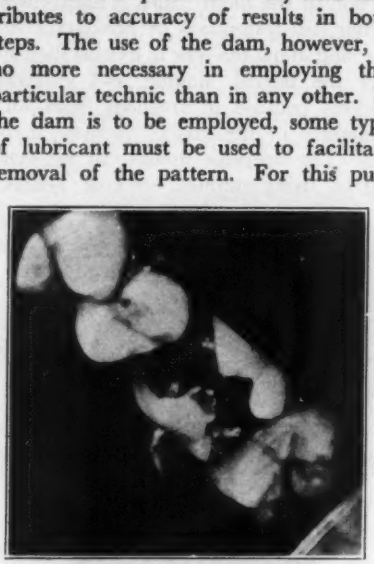


Fig. 11.—Completed wax pattern.

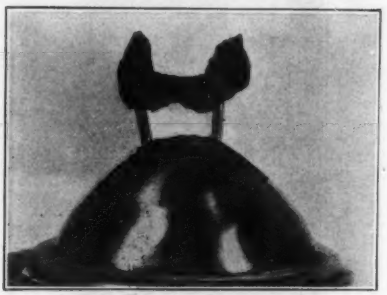


Fig. 12.—Pattern on sprue base ready for investing.

When the cavity has been prepared

and lubricated, the matrix is again placed on the tooth and carefully checked to see that it is brought in contact with the proximal teeth and that sufficient allowance has been made to permit the wax to pass slightly over the proximal and gingival margins.

The pattern is to be made by injecting wax in a liquid condition into the prepared cavity under pressure. A hypodermic syringe having a metal barrel was adapted for this purpose. (Fig. 3.) To bring the wax into working consistency, it is necessary to immerse the syringe, or gun, for from five to ten minutes in a constant temperature bath of approximately 145° F. (63° C.). The Monson compound heater meets this requirement very satisfactorily. Injection of wax at this temperature into a prepared cavity in a sensitive tooth may cause some pain. This is usually slight and only momentary and not such as to cause any injury to the pulp.

A hole approximately the size of the tip of the syringe is drilled through the occlusal impression immediately over the prepared cavity. (Fig. 8.) The impression in the region of the prepared tooth is lubricated with vaselin to permit its ready removal after wax has been forced into the cavity. The use of lubricating oil or a lubricant of the chloroform-cocoa butter combination should be avoided. Either will tend to soften the surface of the compound and make it adhere to the wax.

With the matrix in position on the tooth and the impression lubricated and held firmly in position, wax is forced to all parts of the prepared cavity under pressure and the gun held in position until the wax has hardened. The impres-

Fig. 13.—Inlay before setting and before contact has been soldered.

Fig. 14.—Finished inlay.

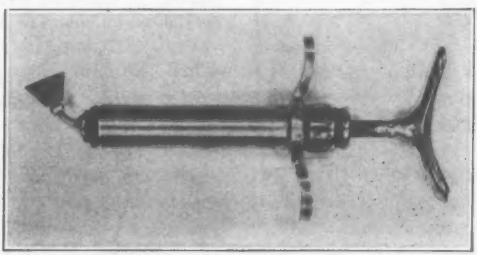


Fig. 15.—Wax gun with Burlew cup for confining wax under pressure without use of occlusal impression.

sion is then removed while the wax is held in position with a blunt instrument inserted in the opening through which the wax was forced into the cavity.

The pattern is burnished carefully to the occlusal margins, wax being added where there may be slight deficiencies. The matrix is removed, care being taken not to disturb the pattern. Proximal and gingival margins are carefully trimmed and the proximal surfaces stripped pre-

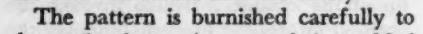


Fig. 16.—Mold used in measuring contraction of wax.

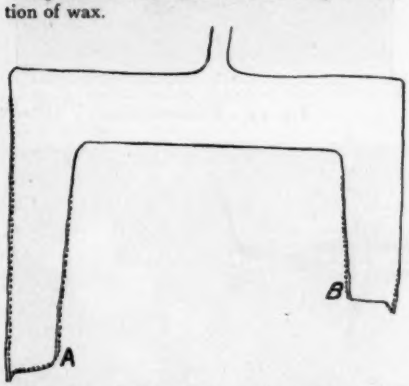


Fig. 17.—Pattern before being subjected to temperature changes (indicated by unbroken line). The dotted line indicates the pattern after the temperature had been increased to that of the body and then reduced to room temperature. The indefinite reproduction of the cavity form at A is to be noted.

paratory to removal of the pattern from the prepared cavity.

Removal of the wax pattern is a step calling for considerable care. Both Thompson[2] and Lasater[3] have emphasized the care that must attend this step if distortion is to be avoided. The former suggests for the removal of a complex pattern the use of two explorers, inserted in the wax in such a manner as to apply the lifting force simultaneously to proximal and occlusal portions of the pattern. The possible unequal application of lifting force would seem not to recommend this method as positive assurance against distortion. Practical application of the multiple sprue method

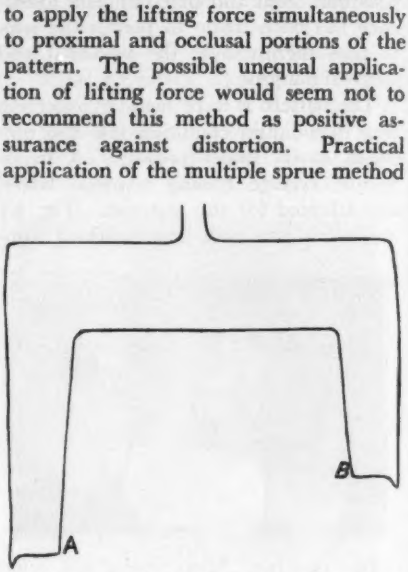


Fig. 18.—Coinciding tracings of wax gun pattern at different temperatures. There is definite reproduction of the angles at A and B.

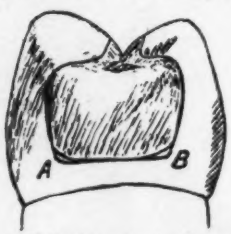


Fig. 19.—Defective margins in proximoclusal inlays, most frequently found at gingival angles A and B. Such faults can be avoided by securing a pattern perfectly adapted to these parts of the preparation.

suggested by Lasater as a means of preventing distortion is the use of the small staple-shaped end of the ordinary 18-gage paper clip. The staple should be spread to bring the ends just over the marginal ridges of the pattern. The two ends are heated and inserted in the pat-

tern. Placing an instrument in the loop will enable the operator to remove the pattern without distortion.

Removing a pattern with a double sprue calls for a different method of mounting on the sprue base from that employed when a single sprue is used. To meet this problem, the hole in the sprue base should be changed to a slot. (Fig. 3.) The hollow under part of the base and the slot are filled with moldine and the double sprue is pressed well into the slot until the pattern is within about five-sixteenths inch of the base. Use of a double sprue of this gage makes reservoirs unnecessary.

Investing is carried out according to the preference of the operator. When the investment has set and the sprue base has been separated from the ring, the sprue is cut with a disk and removed in two separate pieces. In making the casting, the gold will enter the mold through two vents instead of one.

In the case of a tooth the occlusal surface of which is so badly decayed as to furnish little indication as to its original contour or when so little of the tooth is involved in the preparation that the operator prefers to restore the form without the occlusal compound guide, a procedure involving fewer steps can be employed.

The preparation is carried through in the usual way, without an occlusal impression. A matrix of the type already described is applied to the tooth on completion of the preparation. In this instance, however, the matrix is made the full length of the crown. After the wax gun has been kept for the required time in the water bath, a Burlew cup is placed on the tip, serving to confine the wax to the prepared cavity under pressure while the pattern is being formed. (Fig. 15.)

The method of pattern construction just described differs so much from methods ordinarily employed that the question may well arise as to resultant physical changes and whether such changes may not disqualify it for practical use. An inlay approaching any degree of accuracy cannot be produced from a pattern which has undergone excessive shrinkage during manipulation or which is likely to show distortion when heated or cooled within reasonable temperature limits.

To determine the comparative shrinkage which the wax may exhibit under different methods of manipulation, a steel mold was used in which wax was formed into a semicylindrical specimen approximately 5 mm. in diameter. (Fig. 16.) A Brown and Sharp micrometer set at 35 mm. determined the initial length of the specimen.

Test specimens were made (a) by means of the wax gun at a temperature of 145° F. (63° C.) under maintained pressure; (b) by adapting wax immersed in a water bath at a temperature of 125° F. (52° C.) and made to conform to the mold under pressure, and (c) by pouring the wax into the mold without pressure. After hardening, specimens were placed in a room temperature bath, 75° F. (24° C.), and left for five minutes, when the micrometer screw was turned sufficiently to bring it in contact with the specimen. An average of ten readings in each instance showed the following contractions: (a) 0.96 per cent; (b) 0.80 per cent; (c) 2.11 per cent.

The excessive contraction, 2.11 per cent, confirms the observation of Taylor[4] that the contraction of wax on cooling is greater in the absence of compression. Obviously, the poured-wax procedure must be ruled out as a satisfactory method for construction of a pattern. Accordingly, no observations were made relative to possibilities of distortion from unrelieved stress, were patterns formed by this method.

To determine the extent to which patterns made according to the other two methods might be stress-free, a cavity form of the mesioclusodistal type was

constructed, of approximately twice the dimensions of a similar cavity in a natural tooth, the proximal portions being of unequal occlusogingival length. The cavity form consisted of two glass plates clamped to a middle brass plate.

The glass sides provided a means of observing such changes as might be discernible to the naked eye. Patterns were made (a) by means of the wax gun, temperature 145° F. (63°C.), held under pressure until the wax had hardened, and (b) with wax immersed in a water bath, 125° F. (52° C.), for at least thirty minutes and forced over the cavity form, maintaining pressure with a band until the wax could be carved.

Since there can be no good reason for subjecting a wax pattern to a wider temperature range than from that of the ordinary room, 75°F. (24°C.), to that of the body, 98° F. (37° C.), observations relative to distortion were kept within this limit.

In each of the methods under observation, the pattern was placed in a water bath at room temperature, 75° F. (24° C.), and kept there for ten minutes, after which a tracing was made. The projector method employed by Maves[5] and later by Lasater[3] was used, the projector being set so as to give a magnification of approximately 20 diameters. The temperature of the bath was then gradually increased from that of the room to body temperature, 98° F. (37° C.) and held there for ten minutes and another tracing made. After cooling to room temperature, a third tracing was made.

In the case of the pattern made with the wax gun, the three tracings coincided when superimposed over a view box; while in the case of the wax immersed in a water bath, the third tracing, when superimposed on the first, showed noticeable distortion, as indicated in Figure 17. A study of Figure 18, the tracing of the pattern made with the wax gun, shows definite reproduction of the internal angles of the preparation at A and B. A study of Figure 17 shows a sharp reproduction of the angle at B, but a lack of definiteness at A. This failure of wax adaptation at A provides a satisfactory explanation of the defective gingival margins frequently found in the case of proximoclusal inlays (Fig. 19) and furnishes another reason for the rebasing technic employed by some operators in addition to that usually given; i.e., compensation for the contraction of the wax in this region.

While the laboratory studies made showed 0.16 per cent greater contraction in the case of the pattern made with the wax gun than that made with manipulated wax and the clinical observations suggest that differences of this magnitude are not practically discernible, it seems that this unfavorable dimensional change would be more than offset by the assurance of having not only a more stress-free pattern, but also one better adapted to the cavity form.

BIBLIOGRAPHY

1. ARMSTRONG, F. T.: Wax Gun Inlay Technic. *D. Survey*, 12:320, August 1936.

2. THOMPSON, E. C.: Waxing, Investing and Casting Technic. J.A.D.A., 26:771, May 1939.

3. LASATER, R. L.: Control of Wax Distortion by Manipulation. J.A.D.A., 27:518, April 1940.

4. TAYLOR, P. B.: Inlay Casting Procedure—Its Evolution and Effect of Manipulatory Variables. Proceedings Dental Centenary Celebration, 1940, p. 214.

5. MAVES, T. W.: Recent Experiments Demonstrating Wax Distortion on All Wax Patterns When Heat Is Applied. J.A.D.A., 19:606, April 1932.

CONTROLLED USE OF AN ABRASIVE IN OCCLUSAL SURFACE ADJUSTMENT

By J. Lewis Blass,* Ph.G., D.D.S., New York, N. Y.

INTRODUCTION

A METHOD for holding an abrasive in contact with high guiding cusp inclines or interfering cusp points to permit shaping of cusps and occlusal surface coordination by means of controlled mandibular movements; to smooth rough or high surfaces of teeth or fillings; to initiate wear in teeth lacking natural wear, and to protect the height and form of occlusion-supporting cusp points throughout the process is here presented.

EFFECTS OF NATURAL WEAR

Natural wear of occlusal and incisal areas of teeth progresses slowly while the teeth are sustained in function.[1] In later life, natural wear compensates for weakened alveolar support by the reduction in the angle of cusp inclination and of cusp height; consequently, of torque. Wear is inhibited when the diet is restricted to soft, non-fibrous foods owing tc the natural desire or on medical advice in gastro-intestinal disturbances such as colitis and gastric or duodenal ulcer. Wear is also reduced when the use of certain groups of teeth is habitually avoided, or when the bony support is insufficiently resistant to maintain the teeth in position against the wear of use. Wear is increased by habits and nervous disorders in which the teeth are rubbed together; by the action of acid fumes in certain occupations; by acid eructation incident to a digestive disorder; by the action of natural fruit acids, or by the action of lactic acid in the mouth.[3] Lactic acid may be rapidly produced after the solution of tablets of dextrose, sucrose or starch in the mouth, a phenomenon ascribed to the activity of oral micro-organisms.[2] The same phenomenon regarding organic acids is probably also produced through the interaction in the mouth of micro-organisms and hard candies.[3]

Natural wear creates smooth facets with which occlusal contact is rarely rough or annoying. Artificial grinding of the occlusal surfaces with stones or other abrasives, on the other hand, often leaves roughness as an undesirable concomitant. Such roughness may lead to nervous habits, such as diurnal or nocturnal bruxism or even bruxomania. These unnatural uses of the teeth, in addition to being a source of annoyance to the patient, cause increased wear and are generally accepted as etiologic in periodontal disease. Alveoloclasia and tooth mobility may result from the frictional vibration of the teeth against the periodontal membrane and the alveolar bone during functional occlusion; consequently, "the tooth no longer glides by its antagonist, but rocks with it."[4]

The use of sandpaper disks and other abrasives for the elimination of roughness following manual grinding of the occlusal surfaces, while effective in smoothing the teeth, may remove anatomic details essential to chewing efficiency. The use of an abrasive paste or of an abrasive-bearing chewing gum reduces the height of cutting cusps, es-

*Assistant professor of periodontia, New York University College of Dentistry.

sential to function and to the maintenance of the maxillomandibular degree of opening.[5] As a pencil point wears down in use on paper, the indispensable cusp points are rapidly reduced in height, while the cusp inclines over which they move are left essentially unworn.

The need for shaping natural teeth by the removal of interfering cusp inclines so that natural wear would be permitted was stressed by Stillman and McCall.[6]

When the teeth erupt in such a manner that there is incoordination in occlusion, it is found in a number of cases that the individual, through the use of the teeth, produces a wear which reduces the interfering

Fig. 1.—Materials: pink baseplate wax; soft copper foil, 0.0015 thickness; carborundum powder, 320 mesh.

Fig. 2.—Biteblock prepared for use.

prominences and thereby relieves the potential traumatic occlusion. This, however, can only take place under certain circumstances. In the first place, the incoordination must be such as not to cause a severe interference with either lateral or protrusive movement. If interference is sufficiently marked the excursions of the mandible will be so curtailed that the offending points will not undergo wear. Also, it is necessary that the individual acquire a habit of vigorous mastication of food. In other words, function must be very nearly normal from the time the teeth are erupted if adequate compensating wear is to take place.

These observations are made with the express intention of calling the attention of the dentist to the need for the most critical examination of the mouths of even his young patients to detect mechanical incoordination. When it is present and is found to be of a nature which is not likely to be corrected by natural means, steps should be taken to bring about harmony in the interest of the future health of the mouth.

That vigorous mastication is incapable of bringing about a sufficient degree of natural wear in the absence of an abrasive diet is the opinion of Box.[7]

In view of the lack of abrasive action of our modern diet, the use of an adjunct to supply this need is plainly indicated. Its use obviously should be under the observation and control of the dental practitioner.

LIMITATIONS OF TECHNIC

As a preliminary to the use of this

Fig. 3.—Biteblock in position in mouth.

technic, the manual shaping of teeth for form is often desirable. This includes the shortening, by the use of stones, of individual teeth in marked premature contact in centric or eccentric occlusion, the removal of plunger cusps, the shaping of uneven or excessively worn marginal ridges, the reshaping of excessively worn teeth to restore grooves and sulci and the grinding of the lower anterior teeth

to an even plane of occlusion. Subsequently to the use of the abrasive, particularly if deep abrasion is required, the labioclusal and labio-incisal angles of the teeth should be rounded to prevent enamel chipping at these angles. Sandpaper disks can be used for this purpose. Care must be exercised throughout to limit the degree of wear to that which will bring about occlusal coordination, but will not excessively reduce the angle of cusp inclination. Usually, in the absence of marked disharmony, from thirty-five to sixty mandibular movements suffice.

Fig. 4.—Biteblock with grinding planes created by two mandibular movements against softened wax. The copper appears in the areas of premature contact.

Fig. 5.—Cross-section of biteblock in position.

HARMONIOUS WEAR

The proposed method "produces a wear which reduces the interfering prominences and thereby relieves the potential traumatic occlusion"[6] and is fully "under the observation and control of the dental practitioner"[7] so that "the height of cutting cusps essential to function and to the maintenance of the maxillomandibular relationship is preserved."[5]

The method consists in the controlled application of an abrasive by using a wax bite. The materials required are tough pink baseplate wax, cut in half lengthwise; soft copper foil, 0.0015 thickness, 1 inch by 1½ inches, and carborundum powder, 320 mesh. (Fig. 1.) Copper is used in preference to other metals as it makes the most suitable support for the abrasive. During grinding, the carborundum is pressed into the copper and some of the sharp particles remain firmly lodged therein. The use of a harder metal would allow the abrasive powder to be swept away and would require a greater occlusal pressure to assure even a partial result, according to Otto R. Trautz, assistant professor of chemistry, New York University.

To prepare the wax bite, the wax is softened and a sheet of warmed copper is attached to it. The wax strip is folded into 1 inch widths and the whole pressed together to form a biteblock. (Fig. 2.) The metal-bearing side of the biteblock is placed against the teeth to be abraded, usually in the occlusal area of the buccal cusps of the maxillary posterior teeth, the incisal area of the maxillary anterior teeth or the occlusal area

of the lingual cusps of the mandibular posterior teeth. The patient is asked to bite in centric position and the copper and wax are adapted to the teeth to be protected from abrasion. (Fig. 3.) The patient is then asked to execute one or two mandibular movements in the excursion for which adjustment is desired. This creates guiding planes in the biteblock. The wax bite is then chilled. (Figs. 4 and 5.)

A small amount of the carborundum powder is sprinkled in the guiding planes of the specific teeth to be abraded. The patient is asked to close and execute the mandibular movement for which the abrasion is required, slowly and with steady occlusal pressure, a sufficient number of times to produce the degree of abrasion required for occlusal surface adjustment.

SUMMARY AND CONCLUSIONS

One tooth or a series of teeth may be abraded, according to the distribution of the abrasive powder. Loose teeth are held in contact with the biteblock by finger pressure during the mandibular excursion or they are ligated to firmer adjoining teeth. A separate wax bite is made for the protrusive excursion of anterior teeth, for the left and right lateral working function and for relief of high points in centric occlusion. Each excursion—the protrusive and left and right lateral—is done separately. A sufficient number of movements are allowed to produce the degree of desired abrasion, but none is permitted after the copper has worn through, to prevent abrasion of cusp points needed for the maintenance of the maxillomandibular relationship.

BIBLIOGRAPHY

1. GOTTLIEB, BERNHARD: Schmutzpyorrhoe, Paradentalpyorrhoe und Alveolaratrophie. Vienna: Urban & Schwarzenberg, 1925.

2. NEUWIRTH, ISAAC, and KLOSTERMAN, J. S.: Demonstration of Rapid Production of Lactic Acid in Oral Cavity. *Proc. Soc. Exper. Biol. & Med.*, 45:464-467, October 1940.

3. MILLER, S. C., and NEUWIRTH, ISAAC: Tooth Decalcification Due to Hard Candies. *D. Cosmos*, 77:453-459, May 1935.

4. LEONARD, H. J.: Research in Periodontology. J.A.D.A., 19:303, February 1932.

5. SCHUYLER, C. H.: Fundamental Principles in Correction of Occlusal Disharmony. J.A.D.A., 22:1193-1202, July 1935.

6. STILLMAN, P. R., and MCCALL, J. O.: Textbook of Clinical Periodontia. Ed. 2. Philadelphia: Macmillan Company, 1937.

7. BOX, H. K.: Twelve Periodontal Studies. University of Toronto Press, 1940.

THE JOURNAL *of the*
AMERICAN DENTAL ASSOCIATION

L. PIERCE ANTHONY, D.D.S., Editor
Published by the American Dental Association
212 East Superior St., Chicago, Ill.

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to non-members is $5.00 a year in advance, this rate applying to both domestic and foreign subscriptions. All foreign subscriptions are to be paid in United States money.

FEBRUARY *Editorial Department* 1942

JOURNALISTIC ETHICS

THE question of ethics as embodying the conduct of individuals in the profession toward each other and as influencing the conduct of the individual toward the profession has received its full share of attention and consideration, with the result that, several decades ago, a code of ethics was formulated and adopted by the American Dental Association, determining and directing such conduct.

Little attention, however, has been given to the formulation and adoption of a code or system of ethics designed to govern and direct the conduct of the author toward his publication medium or of one periodical toward another. The little of code or standard of journalistic conduct that we have seems, like Topsy, to have just grown up; and the nondescript manner of its origin has been characteristic of its observance.

In the early days of periodical dental literature, the stimulating motive on the whole, with the exception of the then one purely professional journal, was that of promoting the proprietary interests of those who owned and published the journals, and hence every periodical pursued its own way and wish in its dealings with others.

Because of the scarcity of desirable material, it became the custom for

every journal to publish anything or everything that came within its purview, without regard to the rights and privileges of other periodicals or those of individual authors and contributors.

It can readily be seen, then, that, with the increase in the number of publication mediums and the necessarily limited amount of literature, it was every man for himself. And the extent of the adoption of this policy of publishing anything and everything is vividly portrayed in the index of the literature of the early years of dentistry.

In the course of the years, as the profession developed and the amount of literature increased, a few of the leading dental journals became more discriminating in the choice of material, and several of the magazines became outstanding for the character and choice of material published, incidentally establishing a considerable reputation and distinction as publication mediums.

The increase in the amount and the improvement in the character of the publishable material, the spirit of competition that was aroused and the low subscription fees charged by many subsidized journals accounted for the demise of the one independent journal of that day and also accounted for the short life and precarious existence of every journal that essayed to enter the independent field for the first three-quarters of the century of the profession's existence. Within the last two decades, however, the desirability of proprietorship of material became recognized by the better class of periodicals and the rights and privileges of proprietorship of papers read before societies were realized and established soon after the consolidation of the profession into the American Dental Association and the subsequent establishment of an official journal.

To give substance to this thought and purpose, the American Dental Association incorporated into its Constitution and By-Laws, in 1920, the following rules regulating presentation and publication of papers read before the Association:

No paper shall be published as having been read before a section unless it has received the approval of the Executive Committee of said section.

Each author shall hand his manuscript to the section secretary immediately after the reading thereof, and such manuscript must be ready for publication at that time, and must be accompanied by copy for all illustrations needed. The secretary shall indorse thereon that it has been read, and shall hand it to the Executive Committee for its action. All papers approved by the Executive Committee shall be returned to the section secretary, who shall at once forward them for publication to the editor of THE JOURNAL.

No paper shall be published as having been read before a section unless it has actually been read, or unless, for special reasons, when the author has been present

and prepared to read the paper, the section shall vote to have it read by title.

All papers and reports presented to a section, and approved by the Executive Committee, shall become the exclusive property of the Association; but the Board of Trustees may permit an author to publish his paper elsewhere than in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

With the establishment of the principle of proprietorship in regard to articles read at the American Dental Association meetings, THE JOURNAL adopted the policy, in the case of papers read before other societies, of refusing to publish a paper thus read without the full knowledge and consent of the society before which it was read. Nor does THE JOURNAL publish papers simultaneously with other publications or papers or other contributions that have been published previously.

The last item of policy particularly seems little understood by the profession generally. In at least six instances within the past month, we have received requests to publish in THE JOURNAL papers and contributions that have been previously published. On other occasions, we have had material for publication that has been presented to various publications, and we have had any number of requests for simultaneous and even previous publication.

All such requests must, in the nature of the case, be refused, not because, in some instances, the material is not worthy of publication, but because of the large amount of material available and already obligated for publication. While we readily admit the value of repetition in some instances, we cannot in fairness to our clientele adopt the practice of repetition; a practice too common among authors for THE JOURNAL to lend countenance to the evil by republication of papers the only reason for which is the personal wish of the author.

As an example of the injustice that a lack of understanding of the ethics of the case imposes upon an editor, we recently received, with every appearance of an original article, a paper that had been published verbatim, with the exception of the title, eleven years previously. We admit that such an incident, if the paper is published, is a "joke" on the editor, and should serve to increase his alertness, but we submit that such an act violates every principle and spirit of journalistic ethics.

Then, too, there is the matter of the form of manuscripts as they come to the editor. While it is a rather wide stretch to include this feature under the strict head of ethics, it does embody the spirit and purpose of ethics as it relates very definitely to helpful and cooperative aid to the editor in preparing manuscripts, which is frequently overlooked. The By-Laws of the Association specifies in its instructions to Section officers

that the paper shall be an original copy, in widely spaced typing and accompanied by suitable illustrative material with legends attached. In other words, the manuscript shall be ready for preparation for publication.

Much has been said and much is being said about the amount of dental material that is going unpublished, and while we are quite conscious that the amount of material being offered for publication is far beyond the available avenues of publication, we are, even though reluctantly, in the light of long experience slowly but surely coming to the conclusion that there is now being published practically all of the dental literature that is worthy of publication.

The constant effort of the Editor is to maintain scrupulously THE JOURNAL as an avenue of publication of original material of merit—not for repetitious publication, nor for publication of material that has only the qualification of the author's desire for publication—and in this effort the Trustees have accorded the Editor wide discretionary powers in the selection and choice of material.

BIBLIOGRAPHICAL

The 1941 Year Book of Dentistry

Diseases of Mouth: Pathology and Research. Edited by CHARLES G. DARLINGTON, M.D., Professor of Pathology, New York University, College of Dentistry. Operative Dentistry. By GEORGE W. WILSON, D.D.S., Professor of Operative Dentistry, Marquette University. Oral Surgery. By HOWARD C. MILLER, D.D.S. Prosthetic Dentistry. By WALTER H. WRIGHT, D.D.S., Ph.D., Associate Professor of Prosthesis, School of Dentistry, University of Pittsburgh. Orthodontics. By GEORGE R. MOORE, D.D.S., M.S., Professor of Orthodontics, School of Dentistry, University of Michigan. Cloth; 792 pages; 505 cuts from the original articles. Price $3. Chicago: Year Book Publishers, Inc., 1941.

DENTISTS who have not become acquainted with the annual "Year Book of Dentistry" have overlooked a valuable and convenient means of obtaining each year abstracts of important articles from almost 100 dental and medical journals. The editors of the 1941 "Year Book of Dentistry" selected the essential facts and illustrations from a total of 381 articles and published in this volume just enough detail to convey the information presented in the original articles. About one-quarter of the contents of the book came from foreign journals.

The book is divided into five sections: oral surgery; prosthetic dentistry; operative dentistry; orthodontics, and diseases of the mouth: pathology and research. The editors were careful to choose subjects of interest to dental practitioners. The book includes details of sixty-eight new technics; facts regarding fifty-two different types of operations; 177 general treatment methods, and data on ninety-four diagnostic measures. Although emphasis is placed on practical dentistry, dental research is also considered

and the "biologic aspects" of dentistry are not ignored. Critical comments by the editors are inserted after many articles to emphasize or clarify parts of the abstracts.

The 1941 "Year Book of Dentistry" is printed in a convenient size for handling and filing. It will prove a valuable book to every practitioner of dentistry who reads it carefully.

Cancer of the Face and Mouth

By VILRAY P. BLAIR, M.D.; SHERWOOD MOORE, M.D., and LOUIS T. BYARS, M. D. Cloth. 589 pages; 260 illustrations and 64 plates. Price $10. St. Louis: The C. V. Mosby Co. 1941.

THIS new book by Dr. Blair and his associates incorporates the vast experience of this group in the care of cancer of the mouth and face. If for no other reason than this, the volume should prove of great interest to other surgeons called upon to deal with this type of carcinoma. However, the book, by reason of the illustrations, becomes a virtual compendium of information regarding repair of facial defects resulting from the cancerous process and its treatment. The volume is divided into chapters dealing with lesions of various regions of the face, the ear, the eyelids, the lips and the salivary glands. Typical examples of the type of lesion under discussion and its repair are shown by excellent photographs. At the end of the book, a section devoted to operative technic is illustrated by means of line drawings. This section loses much of its potential value because of the poor quality of the drawings, which are produced mainly with staggered lines, making many of the illustrations difficult to interpret. A short chapter by Sherwood Moore on the treatment of cancer of the face with x-rays and radium is included.

The volume concludes with a section on five-year statistics on the survival rate in different forms of cancer, with various types of treatment. It is questionable whether this last chapter is of any value. Too few patients are included in each group and, in general, too few have been adequately followed to allow any conclusions to be drawn. One general criticism may be directed toward this entire book: The text is not clearly conceived and this makes it difficult to read and to follow the facts presented. As a pictorial volume on cancer of the face and mouth and an exposition of methods useful for plastic repair of the face after excision of the carcinoma, it is excellent.

Microbes Which Help or Destroy Us

By PAUL W. ALLEN, Ph.D., Professor of Bacteriology and Head of the Department, University of Tennessee; D. FRANK HOLTMAN, Ph.D., Associate Professor of Bacteriology, University of Tennessee, and LOUISE ALLEN MCBEE, M.S., formerly Assistant in Bacteriology, University of Tennessee. Cloth. 530 pages; 102 illustrations and 13 color plates. St. Louis: The C. V. Mosby Company. 1941.

A POPULAR consideration of the field of bacteriology and public health is provided by this new book. The material presented should be of particular use in teaching such courses in colleges and secondary schools. The volume presents considerable elementary information on the relationship of bacteria to such everyday processes as canning, the uses of disinfectants and antiseptics and the mechanisms involved in resistance and infection. The latter half of the book is concerned with descriptions of diseases and the rôle played by the micro-organisms in their inception. As a text for a survey course in bacteriology or hygiene, this volume should be satisfactory. Two chief criticisms may be applied to the book. First, no workable classification of the bacteria is offered, an inclusion of which should help the student to visualize the extent of the field at least, and, secondly, in the discussion of diseases, a logical consecutive order is not followed. The book is nicely bound and is printed on special tinted, non-glare paper.

Operative Oral Surgery

By LEO WINTER, D.D.S., M.D., F.A.C.D., Sc.D. (Hon), LL.D., Professor of Oral Surgery, New York University. Cloth. 863 pages; 1,019 illustrations. Price $10. St. Louis: The C. V. Mosby Company. 1941.

DR. WINTER has written a new book in an attempt to describe in greater detail the technical phases of oral surgery. This effort is not entirely successful. Dr. Winter has

produced a nice pictorial volume, but the written portions of the text leave much to be desired. The volume covers the usual scope of oral surgery. Anesthesia, exodontia, impacted teeth, acute abscesses, cysts, neoplasms and fractures are described and discussed. Little space is devoted to the methods of removing impacted teeth; the technic of removal is dispensed with in a few paragraphs, and the remainder of the chapter is devoted to a discussion of postoperative care and x-ray pictures of unerupted teeth. The method of tooth sectioning as an alternative to bone removal is mentioned, but is not described. In the section on swellings of the face and neck, an attempt is made to review the differential diagnosis. Here, one finds a number of questionable statements: on p. 157: "Ranula . . . is an acute, painful enlargement of the submaxillary salivary gland due to an obstruction of Wharton's duct"; p. 160: "The cause of lymphosarcoma is unknown, but the condition is thought to be associated with leucemia. It is of an infectious origin"; p. 172: "The adamantinoma is really a hard jaw tumor." On page 173, in the section "Differentiation Between Cysts and Adamantinomas," a discussion is presented for several pages which is duplicated practically verbatim on page 323 and the following pages. On page 177, an attempt is made to differentiate osteitis fibrosa cystica and central benign giant cell sarcoma without revealing the underlying pathologic process or making the disease understandable. Scurvy is discussed under blood dyscrasias on page 196. The section of the book on fractures is nicely written and illustrated, it being evident that the author is on firmer ground here. In general, this volume can scarcely be designated as a scholarly work. The errors incorporated in it are too numerous and gross to be overlooked, and because of these errors and the poor concept of pathologic processes which the author demonstrates, the book cannot be recommended as an addition to the dentist's library.

Pharmacology and Dental Therapeutics

By HERMANN PRINZ, A.M., D.D.S., M.D., Sc.D., Dr. Med., Dent. Prof. Emeritus of Materia Medica and Therapeutics of the Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, and U. GARFIELD RICKERT, A.M., D.D.S., Late Professor of Diagnosis, Dental Therapeutics and Radiology, School of Dentistry, University of Michigan; revised by EDWARD C. DOBBS, D.D.S., Associate Professor of Pharmacology, Baltimore College of Dental Surgery, Dental School University of Maryland. Eighth edition; cloth; 507 pages and 44 illustrations. Price $6. St. Louis: C. V. Mosby Company.

THE popular "Dental Materia Medica and Therapeutics" written by Prinz and Rickert has been thoroughly and completely revised by E. C. Dobbs and is now published under the name "Pharmacology and Dental Therapeutics." The general plan and format of earlier editions have not been altered, although certain chapters have been rewritten and much new material has been added. Only one half as many illustrations appear in this new edition, the authors having deleted many pictures that were obsolete. They have also followed the modern trend of including references to current literature and have listed many of the recent articles pertinent to the subject.

Discussion of the newer drugs, such as sulfanilamide, is included, but the authors recognize that changes and developments in the field of chemotherapy are very rapid, referring the reader to Accepted Dental Remedies and other similar books for more recent information.

The discussion of drugs used in dentistry which is included in this book is concise, accurate and easy to find. This book should continue to be of great value to dental students and practitioners as a reference book and textbook.

ASSOCIATION ACTIVITIES

Contents

PRESIDENT'S MESSAGE 270

BUREAU OF PUBLIC RELATIONS

Public Relations in Orthodontics

T. Wallace Sorrels, D.D.S. 272

Keep America Strong 279

COUNCIL ON DENTAL THERAPEUTICS

Use of Radioactive Isotopes of Elements in Biologic Investigations 280

Accepted Dental Remedies 286

COUNCIL ON DENTAL EDUCATION

Acceleration of the Dental School Program 287

COMMITTEE ON DENTAL PREPAREDNESS

The Preparedness Questionnaire 288

Dental Students and Instructors 291

RESEARCH COMMISSION

Excessive Expansion of Amalgam 292

List of Certified Dental Materials 293

COMMITTEE ON ECONOMICS

Dental Service in Industry 299

COMMITTEE ON LEGISLATION

The Dentist's Federal Income Tax 301

Recent Court Decisions:

Dental Practice Acts: Suspension of License for Advertising Professional Superiority 304

Board of Dental Examiners—Power to Restrict Advertising 305

STATE SOCIETY OFFICERS' CONFERENCE 306

FIVE STATE POST GRADUATE CLINIC 307

MOBILE DENTAL CLINIC PRESENTED TO ROYAL CANADIAN DENTAL CORPS 308

AMERICAN DENTAL ASSOCIATION MEMBERSHIP

Membership Percentage Chart 309

ENDOWMENT FUND FOR THE JOURNAL OF DENTAL RESEARCH 310

CORRESPONDENCE 311

OBITUARY

B. Frederick Philbrook 313

Deaths 314

REQUEST FOR AID IN IDENTIFICATION 315

President's Message

To the Members of the American Dental Association:

THERE is a great and immediate challenge to the dental profession, the challenge of 100 per cent cooperation in the National Emergency. The establishment by the government of a Procurement and Assignment Agency properly places here the responsibility for obtaining dentists for national service. The success of the office of procurement and assignment in our field depends entirely on the complete cooperation of the dentist. Even the most doubting persons must now admit that this is a time of emergency and crisis. There is great necessity to have everywhere an unqualified willingness to serve the country however, wherever and whenever national need requires. Dentistry must stand firm in its purpose to establish the fact that it intends to maintain its place in the forefront of the professions as it always has in the past.

The services which the dental profession can give the nation at the present time are many. They are of key importance. Dentists must play a large and varied part in the national program, beginning immediately. It is their responsibility to determine whether the men called are fit for service as ascertained through examination of the oral cavity, and to make fit, as far as is possible, through corrective work, those potential service men whose dental health can be quickly remedied. The responsibility of dentistry does not stop here, but embraces preventive dentistry for our future soldiers and treatment of the casualties of war which are classed in the field of oral surgery.

We are proud of dentistry. The dental profession was one of the first of the many organized professional groups in the United States to appreciate the importance of military preparedness in advance of the declaration of war and to take effective action. All in our pro-

fession are familiar with the action taken by the House of Delegates of the American Dental Association in 1940, and with the activities of the Committee on Dental Preparedness and the various state committees in compiling information which was brought in, ready to be used the moment the national need arose.

The Army and Navy determine the number of dentists required to serve the members of their ranks. Roughly, the ratio is 1.5 dentists per thousand men in the Army, and 2 per thousand in the Navy. The Procurement and Assignment Agency, now set up, has advisory committees to make policies and decisions with reference to the whole question of health preparedness. This agency is in a position to weigh the needs of the service against the needs of the community, with reference to any one professional man, to the end that civilian services may be preserved to the fullest extent possible consonant with service to the armed forces.

Within a few weeks, the Procurement and Assignment Service will mail to all individuals in the various professions dealing with health a form in which they will be asked to state their preferences for assignment in all of the agencies of the national defense which require dental, medical or veterinary personnel and for service in communities, regarding both public health and other civil categories.

By an immediate response, every dentist, physician and veterinarian of the country will be able to lend maximum support to the national emergency. It is to be hoped that the dentists will maintain the professional prestige by filling out these forms immediately. As a profession, let dentistry again go on record as anticipating a call rather than responding sluggishly or waiting to be drafted into service. Let us rise to the challenge!

Orren a. Oliver

BUREAU OF PUBLIC RELATIONS

PUBLIC RELATIONS IN ORTHODONTICS

By T. Wallace Sorrels, D.D.S., Oklahoma City, Okla.

THE primary purpose of a public relations program for orthodontics is to develop closer and more sympathetic understanding between this major division of dentistry and the general public. Only the profession of medicine ranks in importance above dentistry in the guardianship of public health, and each succeeding year shows more plainly how essential is close coordination between these two professions, since dentistry is, after all, a true specialty within the practice of medicine. Orthodontics, as a chief subdivision of dental practice, assumes a position of prominence in any consideration of public relations, and, as an inevitable corollary, it must likewise assume a greater burden of responsibility for public health. A nation's health is its greatest asset, whether it be at peace or involved in war; but when war threatens, a realization of the value of this asset is bound to become more general and to affect the attitude of the general public toward those agencies most closely concerned in maintaining that value.

The term "public relations" carries widely different meanings in the varied circumstances in which it may chance to be used. But to us it means simply meeting our responsibilities to the public. Public relations is a term to be applied to whatever a professional and business organization may do for the promotion of public welfare. There must be no confusion between public relations and publicity. The first has to do with the creating, shaping and carrying out of those policies which will be reflected in public good will. Publicity, on the other hand, is the procedure of making these policies known to the public. Publicity is thus a part, though a relatively small one, of the wide field of public relations.

What are the policies that we hope to see reflected in public good will? Are they sound? Do they tend to promote equally the best interests of orthodontists, their patients and the public? Are they pursued in such a way as to elicit the approval of both profession and public?

In order to answer these questions, we must examine the relation of the orthodontic profession to the other professions that have to do with the maintenance of health and well-being, and to the public that they are endeavoring to serve. The average citizen who makes his living and provides for his family without looking to the government for aid, who pays his taxes and keeps the law of the land, usually regards his relation to the orthodontist as a purely commercial one. When he or his children need such services, he expects to avail himself of the best to be had and to pay what is demanded, even though he may grumble at the size of the fee. In his mind, the word "public" is very likely to be associated with "going on

Read before the Section on Orthodontia at the Eighty-Third Annual Meeting of the American Dental Association, October 29, 1941, Houston, Texas.

relief." He would resent any implication that, in serving him, the orthodontist is engaged in a coordinated program for the betterment of public relations. The orthodontist merely did what he was paid to do, and Mr. Citizen will very likely add that he was pretty well paid at that.

Yet it is to the established business and professional organizations that the public looks for the performance of social as well as economic services, and though its individual members may consider the relation to be only that of a service rendered for a fee paid, the profession must make ethical considerations paramount. This does not mean that the professional organization is an eleemosynary institution charged with the duty of spreading benefits broadcast to the public with no thought of adequate return. The orthodontist, except in the rarest instances, has his living just as has Mr. Average Citizen, and we have it on the best of authority that the laborer is worthy of his hire. But it is required of him, as of all who are imbued with the true professional spirit, that he render this service in the best manner possible, that he realize fully the responsibility that rests upon him to perform this service well and that, in so doing, he uphold not only his personal standards, but also the standards of his professional organization.

But it is self-evident that he cannot do this unless he receives an adequate return for his efforts. An honorable and sufficient reward is just as essential on one side as an honorable and complete service is on the other. There should be full value for money received, and no effort should be spared to provide it; but he having lived up to all the standards of professional excellence, adequate recompense should be his without question.

The "public," however, comprises many more people than the individual patients who come for treatment. The orthodontist's relations extend far beyond the confines of his office. Besides his patients, actual and potential, there is the community in which he lives and works, the official and unofficial health agencies of that community and of the larger units, county, state and federal government, and the practitioners of his specialty with whom he comes frequently in contact. He must consider, in his public relations, the business firms who supply him with instruments and material, without whose ever-present help he would be powerless to carry on his work; and though there may be some among us who have no debts to worry about, the majority of orthodontists have to consider very seriously, in their public relations, the creditors through whose good offices they are able to "carry on" in foul weather as in fair. And, lastly, we have a most important public relation to those institutions and individuals who educated us, and to whom we must look for the "new blood" which is to keep our profession alive in generations to come.

After we have given to our patients the best service that we can render, on a basis which is profitable and satisfactory to both sides, we must demonstrate to the community in which we live that we are better and more desirable citizens because we are enrolled in an organization that compels adherence to the highest ethical standards. And, to the various health agencies, we owe sympathetic and intelligent cooperation whenever possible, assisting to carry out any program which is sound in principle, and using our best efforts to see that no program which is not sound in principle is foisted upon the public.

With our fellow practitioners, we must cooperate, with a view to maintaining the high ethical standards that our organization requires of us, and even in the event of professional jealousy and of otherwise falling from grace, we must continue to struggle to hold the

standard aloft, firm in the conviction that public necessity transcends personal animosity.

To the supply and business houses on which we are so dependent, we have a most pressing obligation in our public relations. We look to them much as our patients look to us, and we should practice the Golden Rule in offering them the same consideration that we desire our patients to give us. Upon orthodontists, perhaps more than any other practitioners of dentistry, falls the burden of seeking the satisfaction of special needs, constantly arising as the specialty advances in scope and importance; and it is only through intelligent and sympathetic understanding that this progress can continue. And, to our creditors, we not only should pay what is due as promptly as possible, an end toward which I am sure we all are aiming, but also should pay that respect which will maintain a good credit standing in the community and a good will toward our profession in general.

Of our public relations to educators and institutions of learning, much more could be said. A large part of the field to be covered in our program relates to the education of the orthodontist. This program has two basic divisions: (1) relations with the profession and (2) relations with the public.

Under the first head, attention is directed at the outset to the need for improvement within the profession itself. Not until all outmoded educational practices are eliminated or corrected, while others are developed and maintained at the standards now established for practitioners of orthodontics; not until the rank and file of general practitioners and specialists recognize the actual limitations of their knowledge and ability in relation to the public trust, can we hope to see any improvement in public relations between orthodontists and our general educational system. It is the duty of every practicing orthodontist to see that opportunities for education, with teaching of the required standard of excellence, be available to every serious aspirant, under proper conditions and at a fair and reasonable cost to the student.

Dentistry in general, and the specialty of orthodontics in particular, has made such tremendous progress in the past three or four decades that methods which sufficed for our fathers and grandfathers will not serve our sons and grandsons. About thirty-five years ago, a school of orthodontics was established which claimed to be capable of converting dental general practitioners into specializing orthodontists in six weeks' time for the sum of $500. One of the most astonishing things about this claim was that, in a number of instances, it was made good. There are today a number of men high in the ranks of our specialty who had their training in that school. But they have attained this position of eminence only at the expense of the general public upon whom they practiced until they had gained the knowledge and skill which their preliminary education should have provided before, not after, they started to practice. Failure to consider the higher standards supposedly maintained by the professions, allowing inadequately educated practitioners to palm themselves off as especially equipped in some special line, is inconsistent with present-day business ethics. A specialist has been defined as one who knows something about everything and everything about something. Charles H. Mayo offered the medical profession a new definition when he said that becoming a specialist meant knowing more and more about less and less. Whichever definition you accept, the possibility of becoming an orthodontist by taking a few weeks' course in a commercial school, at the rate of about $100 a week, grows steadily fainter. It can be argued with truth that many a dentist has become a cap-

able orthodontist after taking one of these commercial courses. But even though he did come to have more orthodontic knowledge and skill than the ordinary general practitioner of dentistry, he was none the less inadequately prepared and was really self-taught in the old school of experience—and at the public expense.

It is incumbent on us to support high standards of education both in academic and in graduate schools, and to see to it that education in dentistry never falls below the requirements of our American educational system, which are, incidentally, the highest in the world. We can no longer, in fairness to ourselves and to the public, permit dentists to believe it either possible or ethical for them to take a course of a few weeks in a proprietary school or serve a short apprenticeship in some office and thereafter announce themselves as orthodontists fully equipped in accordance with the prevailing educational standards. The diploma mill has been eliminated from the medical profession through organized effort and a sincere desire to raise and maintain at the highest possible level the standards of medical education. In the sister profession of dentistry and its dependent specialties, the same is being accomplished through the cooperative efforts of those individuals and organizations who appreciate the value of establishing standardization in the education of dental specialists.

The American Association of Orthodontists, being the oldest, largest and most distinctive group of specialists in dentistry, has naturally taken the lead in the standardization of graduate education for the practice of the specialties. It rightfully expects its own members to apply to its board for certification of efficiency. The set-up of this board is patterned after the educational code of the American Medical Association and, like that code, has for its objective the protection of the public. It is now virtually compulsory for all graduates in medicine to follow the educational paths prescribed by this code if they would gain professional and public approval, and it is to be hoped that the influence of our organizational efforts in the same direction may meet with equal success. So far, the attainment of such standards has been a purely voluntary professional matter not regulated by civil law. But, in the states of Tennessee, Illinois, Michigan and Oklahoma, there have now been established compulsory minimum requirements in dental education, dental graduates being obliged to prove their fitness to practice the specialties before official examining boards, in order to better protect both the dental profession and the public health.

How needful such legislation is has been abundantly shown by the infestation of the specialties with adventurers and the rise of the mail-order system of orthodontics. These have been the most disturbing tendencies which have confronted our public relations committee. Up to a short time ago, advertisements of self-styled "orthodontic laboratories" were to be seen by the dozen in privately owned dental journals and not a few state dental society official organs. In a competitive effort to gain dentists' patronage, they often offered inducements of a misleading, if not grossly false, character. The editors, all too often, abetted the frauds by recommending mail-order practice in their literary sections, even carrying articles on social and economic problems suggesting, among other remedies, mail order orthodontics.

The Committee on Public Relations was generally successful in persuading the management of most of the dental journals that such advertising and the recommendation of mail order practice were detrimental to the best interests of profession and public. A non-acceptable rating has been given by all dental journals, whether of professional or of private ownership (with one exception) to

advertising by "mail-order orthodontists." Some of the proprietors of these "laboratories" are dentists in disrepute with their professional organization; other laboratories are owned by technicians, and nearly all are manned by technicians who never even matriculated in a dental school, and should never be entrusted with diagnosis and treatment with plaster casts. If the dentist cannot trust his own diagnostic judgment to select and construct appliances to fit the needs of the individual case, how can he hope for better success in an "orthodontic laboratory"? To seek help there is in itself to admit that he is too lazy or too incompetent to do the work that he pretends to be especially fitted to do. Such an unsavory system of supplying orthodontic treatment to the public is exactly as unethical as, or even more so than, the direct mail laboratory system of selling dentures to the public, since misguided orthodontic treatment does more physical and financial damage.

When our rôle in the swiftly moving drama of modern social and economic life has been interpreted and our social responsibilities have been accepted and our policies and practices revised to give greatest service to human needs, we should make the public aware of what we are doing, and what we hope to do in the future to make the world a better place to live in, which is, or ought to be, the object of all such efforts.

This can be accomplished only by publicity, which is the means by which the public is acquainted with these activities and receives an explanation of our policies, becoming familiar with facts that must be recognized in the interests of social and economic welfare. Publicity may flow through many channels. It may come through personal contact, either by word of mouth from one individual to another or by lectures and informal addresses in which one speaks to a group or large audience. Radio addresses carry the idea of personal contact—the sound of the human voice—over an immensely wider area, but the appeal is weakened by this very fact of wider dissemination. Motion pictures carry the appeal through the eyes, and, like the radio, have possibilities of nation-wide distribution, thus becoming one of the best means of publicity. Also appealing through the eyes but in a different way is the literature—magazines, both professional and popular, booklets, pamphlets and newspapers. Publicity may also be obtained by special displays at places of public gathering, and by the efforts of societies already organized for the promotion of the work that we are endeavoring to make known. All these channels are useful under given conditions; all have their difficulties and drawbacks; none is deep or wide enough for the public relations work of an organization like ours. And only by the judicious use of every one of them can we hope to obtain maximum results.

Personal contacts are of great value, but their range of appeal is so limited that they can have no established place in a broad publicity campaign. Speeches or lectures by outstanding men of the specialty may have great appeal, for the effect is not usually limited to the immediate audience, even if it is not broadcast by radio. When they are reported in the newspapers and printed in special or general professional journals, or reprinted in pamphlet form, their distribution may be wide and long continued. Such speeches must be timely and suited to the audience and the occasion. They must be prepared with the utmost care, the speaker being sure that every statement has not only the foundation of truth, but also the appearance. A single misstatement, however trivial, may give ground for criticism or ridicule, which may absolutely nullify the most promising publicity.

Radio publicity is important, for the radio is a molder of public opinion and

as a builder of good (or ill) will has few equals. It reaches large audiences over immense stretches of territory. It presents our message in the form intended without subsequent editorial revision, such as it too often gets in newspaper releases. Ushered in usually by a program of entertainment or instruction, the radio message is very likely to reach those in a frame of mind favorable to its reception, or, at least, not definitely antagonistic. Its reception requires no effort on the listener's part: he does not have to purchase tickets, buy books or magazines or even search the pages of the newspaper: he has only to turn the dial, relax and listen. The success of the appeal depends on the persuasive personality of the speaker and the human interest of his subject. But to purchase time on the air emphasizes the old saying that "Time is money."

The same is true of motion pictures. Though the film is the best of all mediums, appealing as it does to both the eye and the ear, its cost is so great as to prevent its more general use for purposes of publicity. Movies are particularly adapted to educational work. They permit one to present a complete, interesting series of impressions, the ear receiving the explanatory facts while the eye beholds the subjects of the explanation virtually as they appear in real life. The fact that the same films may be used again and again, and sent for long distances at trifling expense, somewhat reduces their total cost as agents of publicity, but it none the less remains high.

The principal means of reaching the public is still the printed word. Newspaper have the widest distribution, but paid advertising appearing as such in a medium that costs but a few cents never has the force of the same material in the guise of a book or a magazine article. Books must, however, be ruled out of any publicity campaign, since the majority of those that we wish to reach would not purchase or even open a book upon so special a subject as orthodontics. But our message in a popular magazine of national circulation will be read by a much larger group than that seeing the metropolitan newspaper. The newspaper is read the day that it appears and is then thrown away. The magazine article will be read more sympathetically and carefully, and as the magazine is good for a month or more, it may be referred to again and again. Moreover, the magazine has a selected audience, very apt to be interested in the type of article presented.

In the newspaper, the release must be of immediate interest, and so is very likely to be short-lived. In the magazine, the article can be illustrated and so made of enduring interest and educational value. The newspaper must condense the facts, with little opportunity for going into details. One must work fast, under conditions often adverse; while the magazine article allows leisurely preparation.

Whether distributed by magazine, newspaper or radio, paid advertising, when it appears as such, will not serve the purposes of publicity for such a program as ours, save under exceptional conditions. The psychologic attitude toward anything commercially advertised, especially anything having to do with health and its promotion, is such that we cannot hope to reach the audience that we seek, or make the impression for which we strive, if our appeal is made through the paid advertisement. This attitude on the part of the public is all too often misunderstood by members of the profession. It is our feeling that when so many facilities are at our disposal, offered by altruistic individuals and organizations interested in our aims, there can never be need for the employment of any type of paid advertising in periodicals, either magazines or newspapers. Perhaps, under exceptional conditions—of a political character, for example—it might be advisable to "buy

time on the air" to mold public opinion or arouse professional interest.

Pamphlets and booklets might possibly be classed as "paid" advertising, but their appeal is of a different character, and does not suffer from the same psychologic disadvantages as the magazine or newspaper announcement in the advertising section. Such printed matter usually finds its way into the hands only of those who are interested and therefore willing to examine it thoroughly and appreciatively. The message is carried in an enduring form, and any misrepresentations or mistakes which earlier publications may have been burdened with can be rectified before the booklet or pamphlet is finally issued. This medium has almost limitless possibilities in furthering public relations objectives. Statements of policy, or pronouncements on timely topics, when clearly presented in printed pamphlets, serve excellently to set forth the position of an organization in relation to the activities of other, and perhaps antagonistic, groups.

Another excellent means of telling our story to the public is the educational display. By this means, there can be shown in detail dental anomalies and their cause, prevention and effect upon the mouth and the whole body, with the conditions before and after correction. The educational display gives an opportunity to reveal the romance of our profession and to give to outsiders a glimpse of the spirit behind our organization and its important rôle in the drama of public health betterment. Thus, the message of the educational exhibit reaches both profession and laity. The necessary limitation of those who see it is its greatest drawback, and its power for publicity is dependent on the skill of those who present it, in making engagements for its display in as many and as varied gatherings as can be reached. When well managed, the educational exhibit becomes one of publicity's strongest instruments.

From what has been said, it is evident that it is no easy task to obtain satisfactory and sufficient publicity that will in no way lower the dignity of the profession, and, at the same time, give evidence of our desire to be in the forefront of dental progress. The best results will undoubtedly be obtained by the employment of a full-time publicity agent who will work under the supervision of the Committee on Public Relations. Both agent and committee members should have special qualifications for this work.

The Public Relations Bureau of the American Association of Orthodontists has placed the major emphasis upon attention to health groups, believing that, through them, those of the general public who are interested would, in time, be reached. Scattering shots at the public as a whole are expensive and have intangible results. Intensive work with health groups, as shown by a volume of correspondence, is a method by which some measurement of results can be made.

I have tried to outline for you the meaning of public relations in orthodontics; to note those points of contact between our profession and the general public which are most vital in the promotion of satisfactory public relations, and to consider somewhat in detail the chief objectives of the program mapped out by the Committee on Public Relations. I have given particular attention to the adequate education of the orthodontist, and the relation which the profession bears, or should bear, to the institutions and other agencies responsible for orthodontic education.

After differentiating between public relations and publicity, I have touched briefly on the need for publicity in order to make known our aims in public relations, and have discussed the advantages and drawbacks of the various means through which publicity can be obtained, stressing the special values of each kind.

It has been my aim to indicate the means by which the relations between the profession of orthodontics and the general public can be made closer, more harmonious and more beneficial to both parties involved, without sacrifice of professional dignity or lowering of professional standards. Though much has already been accomplished along these lines, much remains to be done. Let us, therefore, redouble our efforts toward the establishment of better public relations as one of the most potent instruments for the progress and perfection of our specialty.

BIBLIOGRAPHY

1. Report of the Public Relations Committee of the American Association of Orthodontists. *Am. J. Orthodontics*, 26:891, September 1940.

2. Report of Public Relations Committee of the American Association of Orthodontists. *Am. J. Orthodontics*, 27:514, September 1941.

3. Wright, Milton: Public Relations for Business: New York. McGraw-Hill Book Co., Inc.

1003 Medical Arts Building.

KEEP AMERICA STRONG

SIXTH NATIONAL SOCIAL HYGIENE DAY—FEBRUARY 4, 1942

Keep America Strong—Help Build Better Health is the theme of the Sixth National Social Hygiene Day, to be observed on Wednesday, February 4, 1942, according to Dr. Walter Clarke, Executive Director of the American Social Hygiene Association.

Five years of Social Hygiene Day celebrations has meant five more years of continuous effort to tell Americans why syphilis and gonorrhea must be driven out and how this job can be done. Today it is evident that these two diseases are among the gravest dangers which threaten national health and strength. One of the surest ways to help keep America strong is to fight syphilis and gonorrhea and their chief source of spread—commercialized prostitution. You can give this help by taking part in Social Hygiene Day.

Write to the American Social Hygiene Association, 1790 Broadway, New York City, and offer your assistance. Ask for the Social Hygiene Day folder describing this event and suggesting activities for cooperating groups.

COUNCIL ON DENTAL THERAPEUTICS

USE OF RADIOACTIVE ISOTOPES OF ELEMENTS IN BIOLOGIC INVESTIGATIONS

IN view of the interest members of the profession are showing in research activities, the Council referee, with the assistance of Harold C. Hodge, prepared the following article. The Council voted to adopt the article for publication.

HAROLD L. HANSEN, *Secretary.*

THE therapeutic effects of radioactive substances are so generally appreciated that they may serve to increase the interest in developments of another character in this field of radioactive substances. By way of introduction, it may be mentioned that the characteristic properties of some of the natural radioactive elements were employed in biologic research almost twenty years ago. In 1923, von Hevesy[1] used radioactive lead as a "tagged" atom in the study of circulation of lead in plants. Radioactive bismuth was used[2] in an attempt to follow the course of bismuth preparations in the treatment of syphilis. Various other naturally occurring radioactive substances were used for other purposes. It is quite evident, therefore, that scientists have long appreciated the possibilities inherent in the use of "tagged" or tracer elements the presence of which could readily be detected by physical means.

The discovery of artificial radioactivity by Curie and Joliot in 1934[3] served to promote the current widespread activity in this field. These workers found that when aluminum was bombarded with the alpha particles of polonium, the target continued to emit positrons (positive electrons) even after the radioactive polonium was removed. Shortly after this discovery, many more artificially radioactive elements were produced. The production of physical devices, such as the cyclotron, capable of supplying particles of enormous speed has made possible the production of relatively large quantities of radioactive elements. As a result of various developments in physics, it is now possible to subject elements to a number of high speed charged particles (deuterons, alpha particles, protons) and neutral particles (neutrons), and to high energy gamma rays and x-rays. At least one radioactive isotope of each element has so far been prepared and identified, and, in all, 350 radioactive elements or radio elements have been described or mentioned in the literature.[4]

Combinations of neutrons and protons are contained in the nuclei of atoms. The proton has a mass of 1 and a positive charge of 1 and is designated ${}_1H^1$; the subscript denoting charge; the superscript, mass. Since the neutron carries no charge, but has a mass of 1, it is written ${}_0N^1$. Protons and neutrons may be looked upon as the "building blocks" of the atomic nucleus. The number of protons contained in the atomic nucleus, which determines its charge, is called the atomic number. The mass of the atom is determined by the number of protons and neutrons in the nucleus. Isotopes are elements of the same atomic number, but of different atomic weight. They may occur naturally or be produced artificially. They may be stable or may disintegrate spontaneously and at various speeds. Since we are concerned here with artificially produced unstable isotopes, a brief explanation will be made

of the changes occurring in the production and disintegration of one radio element.

Oxygen, with an atomic number of 8, is a mixture of isotopes. The isotope present in largest quantity has an atomic weight of 16. An isotope of atomic weight 18 is present in much smaller quantity. When water is bombarded with high speed protons, the nucleus of the oxygen of weight 18 ($_8O^{18}$) takes up a proton, thus changing to an element of atomic number 9. At the same time, the newly formed element loses a neutron, thus undergoing no net gain in weight. The change may be represented as follows:

$$_8O^{18} + _1H^1 \rightarrow _9F^{18} + _0N^1$$

(Formation of radiofluorine.)

The isotope of fluorine thus produced differs from the common stable isotope of fluorine ($_9F^{19}$) in that it is radioactive and has a lower atomic weight. The radioactive isotope reverts to oxygen ($_8O^{18}$) by the loss of one positron (a positively charged electron). The change may be depicted as follows:

$$_9F^{18} \rightarrow _8O^{18} + _1e^0$$

(Disintegration of radio fluorine.)

The rate of change is such that one-half of the radioactive fluorine atoms have reverted to oxygen in 112 minutes; that is, the half life is 112 minutes. The behavior of fluoride in the body can be studied by means of this disintegration because the positron emitted can be detected mechanically.

The detection of and the quantitative determination of radio elements is in itself a broad topic. A number of instruments capable of detecting and "counting" particles emitted by radioactive substances have been developed. The earlier types of instruments were of the electroscope type and apparatus of this kind have been used for finding lost radium. One of the most sensitive devices is the Geiger-Müller counter. Since this instrument is sensitive to ionizing particles of all kinds, in its use allowances must be made for stray radiations.

The number of articles in the literature dealing with the application of radio elements to biologic problems is too great to permit an adequate review of this broad topic here. Interesting general reviews have been presented by Hevesy[5] and by Lawrence.[6]

Developments in general biology and medicine are always of interest in dentistry and sometimes of considerable importance. For that reason, brief reference will be made to some of the recent findings in that field, particularly since they will serve to indicate the wide range of usefulness of the radioactive elements in biologic problems in general. The accompanying table[7] indicates in a general way the radio elements which have been most widely used.

By the use of radio elements, studies have been made on the uptake and distribution of various elements including iron, iodine, sodium, potassium, calcium, phosphorus and sulfur. The studies on radioactive iron are of interest in connection with various investigations on anemia. Studies on radioactive iodine indicate a surprising rapidity of absorption of this element by the thyroid gland. Radioactive phosphorus has been widely used in connection with studies on phospholipid metabolism of various organs and tissues, including some types of carcinoma. Thus, it may be seen that the radio elements represent a tool that may be used for comparison of metabolism in various tissues and determination of relative rates of metabolism in health and in disease.[5, 6]

Of more direct interest are studies on teeth and bones in which radioactive isotopes of fluorine, calcium and phosphorus and strontium have been used. *In vitro* studies[8] utilizing the first mentioned element have shown that bone, dentin, enamel and hydroxyapatite adsorb fluoride in about the same fashion, an indication of similarity in the com-

position of these substances. *In vivo* studies[9, 10] on cats and on rats indicate that intraperitoneally injected fluoride leaves the blood stream rather rapidly with corresponding rapid absorption by the skeletal tissues. Some of the fluoride is also excreted through the saliva. Despite the use of fairly large doses, urinary and salivary excretion occurred in appreciable amounts only when the blood concentration of fluoride was high. The authors concluded that the failure to find labeled, or marked, fluoride in the dental tissues well removed from the pulp does not support the possibility that fluoride may be deposited in the dental enamel via the circulation. The short half-life of the radioactive isotope does not, however, raise the hope of obtaining more definite information on this point by the methods used.

Radioactive phosphorus has been used widely in studies on metabolism in the calcified tissues. When radioactive phosphorus is introduced into the blood plasma, it diffuses into the extracellular spaces rapidly.[11] In experiments of short duration on rats, the skeleton and muscles contain about the same amount of P^{32}, but, over a period of time, the proportion changes in favor of the skeletal system. After ninety-eight days, 92 per cent of the P^{32} is found in calcified tissues. In rats, the retention of orally administered radiophosphate assumes the following order: bone, liver, stomach plus small intestine, heart, kidneys, lungs, blood, muscles, skin and brain.[12]

While it is convenient to segregate the various systems as indicated above, it should be noted that there are variations in the rate of absorption and extent of retention in tissues belonging to the same system. Several investigators[13] have found that there are large differences in absorption and retention of radioactive phosphorus in various parts of the skeletal system. Obviously, this situation necessitates caution in interpretation of results.[14] Likewise, variations in age and dietary and other factors should be borne in mind in the evaluation of findings.

The latter point is undoubtedly pertinent in connection with studies on rickets. In this condition, "the comparison of the uptake is made difficult by the fact that the phosphorus content of rachitic animals is appreciably lower than that of normal ones; thus the administered labeled phosphorus will be less diluted by non-labeled phosphorus in the rachitic animals."[5]

It has been observed, however, that vitamin D raises the inorganic phosphorus uptake in bones by from 25 to 50 per cent. From indirect evidence, it was concluded that vitamin D may aid in the conversion of organic to inorganic phosphate in the bone.[15]

In the initial studies in this field,[16, 17] it was shown that radioactive phosphorus is taken up by the teeth of rats, cats and man. The results obtained indicated a slower uptake of labeled phosphorus in the teeth of cats than in the continually growing incisors of the rat. The uptake of P^{32} is greater in young than in older animals. Studies on the dental enamel of cats did not yield conclusive results. In the studies on rats, definite differences in the rate of uptake of labeled phosphorus by calcified structures were found.

When a single dose of disodium phosphate containing radioactive phosphorus is administered by stomach tube to normal rats, a rapid deposition of marked phosphorus in the long bones takes place. Epiphyseal bone (spongy) takes up phosphate more rapidly than dense diaphyseal bone, but the latter retains phosphorus longer. Results obtained on these rats in a twenty-day period showed that the incisors take up marked phosphate more rapidly than the molars, in which a very slow, but measurable turnover takes place. In this report, no distinction was made between enamel and dentin.[18]

Volker and Sognnaes[19, 20] have followed the course of radioactive phos-

phorus administered to cats, dogs and a monkey. Their results showed that labeled phosphorus is taken up by bone, dentin and enamel. However, maxillary and mandibular bone contained per gram of inorganic tissue about four times as much marked phosphorus as the dentin. Of the total dose found in the teeth, the dentin accounted for about 91 per cent and the enamel for 2.3 per cent. These investigators made and repeated the interesting observation that surface layers of enamel show a greater concentration of marked phosphorus than the inner layers. It was suggested that this increased concentration in the outer layer of composition after eruption as a result of nutritional changes.

From results of studies on a mature dog, it may be concluded that the dentin takes up radioactive phosphorus to about the same extent as does dense diaphyseal bone. On the other hand, the amount of labeled phosphorus in the enamel was insignificant, indicating a lack or a low order of metabolic activity in this tissue.[24]

Only a few reports in the dental literature deal with *in vivo* studies on human teeth. The early reports of Danish investigators were necessarily fragmentary and exploratory. The results they

SOME RADIO-INDICATORS USED IN BIOLOGIC RESEARCH

Element	Half Life	Made from	Bombarding Particle
Phosphorus	14.5 days	Sulfur	Neutron
Arsenic	14 days	Phosphorus	Deuteron
Sodium	14 hours	Germanium	Proton
Iodine	8 hours	Sodium	Deuteron
	and	Iodine	Deuteron
	8 days	Tellurium	Proton
Selenium	40 days	Arsenic	Proton
Potassium	13 hours	Potassium	Deuteron
Copper	13 hours	Copper	Deuteron
Iron	42 days	Iron	Deuteron
Sulfur	84 days	Sulfur	Deuteron
Fluorine	110 minutes	Oxygen	Proton
Chlorine	37 minutes	Chlorine	Deuteron
Carbon	20 minutes	Boron	Deuteron

may be attributed to adsorption of marked phosphate from the saliva. *In vitro* findings[21,22] on adsorption of radioactive phosphorus by bone, dentin, enamel and hydroxyapatite may be cited in substantiation of this belief.

In studies on cats, Hevesy and Armstrong[23] found that the activity of marked phosphorus in the enamel was from 6.7 to 10 per cent of that of the dentin per gram. These authors concluded that a slow exchange of phosphorus in the enamel takes place, but that the results obtained do not indicate an ability of this tissue to undergo significant changes obtained were of a character which would permit only the general conclusion that the teeth are capable of taking up radioactive phosphorus. The same is also true of the observations of Lawrence, Scott and Tuttle.[25]

Recently, Pedersen and Bodil-Schmidt[26] presented a critical review of the available information in this field and also reported the results of *in vivo* studies in young patients to whom radiophosphate was administered orally. Only two patients, girls aged 14 and 10 years, respectively, were studied. The teeth examined were sound and were selected

because of necessity for extraction apart from this study. In some cases, teeth were isolated from contact with the saliva. In brief, the results obtained indicated that (a) the uptake of phosphorus in the dentin, which was studied separately, is significant, but the activity in root dentin is much higher than that of the crown; (b) even in young patients, P^{32} did not pass from the dentin to the outer or middle portions of the enamel in significant quantities; (c) the enamel surfaces can adsorb phosphate.

The effect of pregnancy on phosphorus turnover in the bones and teeth is a subject of considerable importance. It is therefore of interest to note that, in investigations on rats, there is no significant effect of pregnancy either alone or in combination with dietary deficiency on the marked phosphorus distribution in the maternal skeleton.[27] On the basis of data obtained, it was concluded that neither the maternal bones nor the teeth suffered a marked loss of inorganic material due to gestation. This viewpoint does not coincide with that of Lawrence,[6] who, on the basis of preliminary and indirect studies on human teeth, concluded "these studies emphasize the importance of a diet adequate in phosphorus and calcium during pregnancy."

Radioactive calcium has not been used so widely as has radioactive phosphorus in studies on bones and teeth. Ca^{45} is obtained in relatively low yields and emits a soft beta radiation. Activity determinations with this element are time consuming. Campbell and Greenberg[28] reported that when radioactive calcium (half-life, 180 days) is given to rats in the postabsorptive stage, the specific retention in the tissues is highest in teeth and in bones, being about equal. However, whole teeth were used in these studies and no results on enamel and dentin separately were presented. More recently, the Pechers[29, 30] reported the results of studies with radiocalcium and radiostrontium. The latter is superior to radiocalcium in ease of preparation, yield and activity determination. Apparently, the uptake of calcium is greater in the animals studied, but both elements tend to become concentrated in the skeleton. Analysis of the skeletal tissues of rats and rabbits showed that activity of the injected radiocalcium or radiostrontium is higher in vertebral bones than in most other tissues. It is of interest to note that the average activity of the teeth was higher than that of the bones. On the other hand, it was reported that the base of the incisor teeth had an unusually high activity. Autoradiograms indicated very high activity in the roots of the teeth. No attempt was apparently made to determine the activity of enamel and of dentin separately. The results obtained with white mice indicated that mobilization of calcium from the skeletal system takes place during the last few days of pregnancy. Calcium taken from the skeleton can pass to the offspring through the milk.

In the present state of knowledge concerning the use of radioactive elements, it is possible to draw certain conclusions from studies on dental tissues:

1. There can be no question as to the usefulness of radio elements properly employed in problems of dental interest. It is, of course, self-evident that the results obtained must be interpreted with the nature of the methods employed in mind and in relation to knowledge accumulated from other sources.

2. Results obtained with the radio elements emphasize the need for distinguishing between the various calcified tissues of the teeth.

3. There is evidence that metabolism takes place in the dentin, and this finding is in harmony with results obtained in other types of investigation. However, the metabolic rate in the dentin is low, being of about the same order as that in dense diaphyseal bones. Hence, it is to be expected that extreme conditions of calcium deprivation would be

needed to effect withdrawal of calcium from fully formed dentin.

4. In fully formed enamel, metabolic processes, as these are generally understood, are either non-existent or of a low order. Nutritional changes can scarcely be expected to bring about changes in the composition of fully formed enamel.

5. Adsorption of phosphate of saliva on the enamel surfaces can take place. The significance of this finding in relation to the problems of enamel caries is not clear. It must be weighed against the opposing destructive forces responsible for caries of the enamel, with special emphasis on the comparative rates and extent of each action.

6. Metabolic activity in the dental hard structures appears to vary somewhat with age. It is possible that other factors are of importance, and this should be determined by investigation. This point has been discussed by others[26] and suggestions for further investigations have been made by Ostby.[31]

BIBLIOGRAPHY

1. VON HEVESY, GEORGE: *Biochem. J.*, 17: 439, 1923.

2. LOMHOLT, S.: *Ann. de dermat. et syph.*, 6:260, April 1925.

3. CURIE, M., and JOLIOT, F.: *Nature*, 133:201, 1934.

4. SEABORG, G. T.: *Chem. Rev.*, 27:199, August 1940.

5. VON HEVESY, GEORGE: *Ann. Rev. Biochem.*, 9:641, 1940. Annual Reviews, Incorporated, Stanford University.

6. LAWRENCE, J. H., in Handbook of Physical Therapy. Ed. 3. Chicago: American Medical Association, 1939, pp. 438-455.

7. BALE, W. F.: *Radiology*, 35:184, August 1940.

8. VOLKER, J. F., et al.: *J. Biol. Chem.*, 134:543, July 1940.

9. WILLS, J. H.: *J. D. Res.*, 19:585, December 1940.

10. VOLKER, J. F.; SOGNNAES, R. F., and BIBBY, B. G.: *Am. J. Physiol.*, 132:707, April 1941.

11. VON HEVESY, GEORGE: *J. Chem. Soc.*, 1939, p. 1213.

12. COHN, W. E., and GREENBERG, D. M.: *J. Biol. Chem.*, 123:196, March 1938.

13. Bibliography, reference 5.

14. MANLY, R. S.; HODGE, H. C., and MANLY, M. S.: *J. Biol. Chem.*, 134:293, June 1940.

15. COHN, W. E., and GREENBERG, D. M.: *J. Biol. Chem.*, 130:625, October 1939.

16. VON HEVESY, GEORGE; HOLST, J. J., and KROGH, AUGUST: *Kgl. Danske Selsk. Biol. Med.*, 13:34, No. 13, 1937.

17. VON HEVESY, GEORGE, and CHIEWITZ, O.: *Kgl. Danske Selsk. Biol. Med.*, 13:24, No. 9, 1937.

18. MANLY, M. L., and BALE, W. F.: *J. Biol. Chem.*, 129:125, July 1939.

19. VOLKER, J. F., and SOGNNAES, R. F.: *J. D. Res.*, 19:292, June 1940.

20. *Idem: Am. J. Physiol.*, 133:112, May 1941.

21. MANLY, M. L., and LEVY, S. F.: *J. Am. Chem. Soc.*, 61:2588, October 1939.

22. HODGE, H. C., et al.: *J. Biol. Chem.*, 138:451, April 1941.

23. VON HEVESY, GEORGE, and ARMSTRONG, W. D.: *J. Biol. Chem. Proc.*, 133:XLIV, 1940.

29. MANLY, M. L.; HODGE, H. C., and VAN VOORHIS, S. N.: *Proc. Soc. Exper. Biol. & Med.*, 45:70, October 1940.

25. LAWRENCE, J. H.; SCOTT, K. G., and TUTTLE, L. W.: *Internat. Clin.*, 3:33, September 1939.

26. PEDERSEN, P. O., and SCHMIDT-NIELSEN, BODIL: *Tandlaegebladet*, 396, April 1941.

27. MANLY, M. L., and LEVY, S. R.: *J. Biol. Chem.*, 139:35, May 1941.

28. CAMPBELL, W. W., and GREENBERG, D. M.: *Proc. Nat. Acad. Sc.*, 26:176, March 1940.

29. PECHER, CHARLES: *Proc. Soc. Exper. Biol. & Med.*, 46:86, January 1941.

30. PECHER, CHARLES, and PECHER, JACQUELINE: *Proc. Soc. Exper. Biol. & Med.*, 46: 91, January 1941.

31. OSTBY, B. N.: *Den Norske Tannlaegefor. Tid.*, 49:394, December 1939.

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

ZINC OXIDE-ROSIN-EUGENOL CEMENT

The Council voted to adopt the non-proprietary designation "Zinc Oxide-Rosin-Eugenol Cement" with the understanding that brands of this preparation containing other ingredients bear, as part of the principal title, a notation indicating the presence of such other therapeutic agents as might be contained in the product. The Council has also considered, in connection with products of this class, reports appearing in the dental literature, and especially a recent report on zinc oxide-eugenol cements (J.A.D.A., 26:1536-1540, September, 1939) and a report on zinc oxide impression pastes (J.A.D.A., 21:2099, November, 1934). The uses of zinc oxide-eugenol cements, with or without rosin, are described in A.D.R., Ed. 7, p. 223.

Moyco Zinc Oxide-Eugenol Cement with Menthol and Thymol Iodide:

Powder: Each hundred grams is stated to contain zinc oxide, U.S.P., 95 gm.; thymol iodide, U.S.P., 5 gm.

Liquid: Each hundred grams is stated to contain eugenol, U.S.P., 46 gm.; rosin, U.S.P., 40 gm.; oleic acid, U.S.P., 9 gm.; menthol, U.S.P., 5 gm.

Manufactured by the J. Bird Moyer Co., Inc., Philadelphia, Pa.

This product was introduced as "Pulp Conserver." In order that the identity of the product might not be lost to the trade in the adoption of a name in conformity with the Council's rules on nomenclature, the Council has agreed that the firm may retain on the package label for a period not to exceed one year the notation: Formerly PULP CONSERVER.

ZINC OXIDE-EUGENOL CEMENTS*

Zinc Oxide and Thymol Iodide Cement and Eugenol with Balsam Peru-Condit:

Powder: Each hundred grams is stated to contain zinc oxide, U.S.P., 88.88 gm.; thymol iodide, U.S.P., 11.12 gm.

Liquid: Each hundred grams is stated to contain eugenol, U.S.P., 96.97 gm.; balsam of Peru, U.S.P., 3.03 gm.

Manufactured by P. N. Condit, Boston, Mass.

This product was introduced as "Condit's Anodyne Filling." In order that the identity of the product might not be lost to the trade in the adoption of a name in conformity with the Council's rules on nomenclature, the Council has agreed that the firm may retain on the package label for a period not to exceed one year the notation: Formerly Condit's Anodyne Filling.

DENTIFRICES†

Gray's Tooth Paste: Composition: See Comfort Brand Tooth Paste (A.D.R. Ed. 7, p. 106).

Manufactured by the Comfort Manufacturing Co., Chicago, Ill. Distributed by Gray's Cut Rate Drug Co., St. Paul, Minn.

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information regarding the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

*A.D.R. Ed. 7, p. 223.
†A.D.R. Ed. 7, p. 102.

COUNCIL ON DENTAL EDUCATION

ACCELERATION OF THE DENTAL SCHOOL PROGRAM

AT a special meeting held in New York City on Saturday, January 17, 1942, the Council on Dental Education of the American Dental Association unanimously adopted a report and a series of recommendations to the dental schools of the United States with reference to the acceleration of their courses of study for the period of the emergency.

The report and recommendations of the special committee, consisting of Dr. John T. O'Rourke, Dean of the School of Dentistry of the University of Louisville, Dr. Leroy M. S. Miner, Dean of the Harvard Dental School and Dr. J. Ben Robinson, Dean of the Baltimore College of Dental Surgery of the University of Maryland, and President-elect of the American Dental Association, as adopted by the Council, read as follows:

The Council on Dental Education of the American Dental Association announces to the dental schools of the United States that while it recognizes and is in sympathy with the motives which may prompt dental schools to accelerate their programs, it also recognizes that the needs of the Armed services and of the civilian population cannot adequately be met if the operation of such programs requires or leads to loss in the effectiveness of learning or instruction. Therefore, the Council recommends:

(1) That accelerated programs be adopted for the period of the war in those cases where dental schools are able to do so without loss in the effectiveness of their work;

(2) That there be no reduction in the number of hours devoted to the dental course and that this number be within a range of 3800-4400 hours and be distributed throughout the accelerated program in such a way as to avoid overcrowded student and faculty schedules; and that in the adjustment of the schedule of instruction for an accelerated program of three calendar years there shall be no appreciable diminution from the total hours heretofore scheduled in four academic years within the limits prescribed by the Council;

(3) That wherever a school adopts an accelerated program, the curriculum should include at least the subjects listed in the Council's *Requirements for the Approval of a Dental School* as amended October 24, 1941;

(4) That plans for accelerated programs should make transition from the four-year schedule with the least possible confusion, and should permit an easy return to a four-year schedule at the end of the national emergency;

(5) That so far as practicable, the schools which adopt an accelerated program begin such a program for all classes now enrolled at the close of the present academic year;

(6) That in order to facilitate opportunity for graduates from an accelerated program to take licensing examinations promptly after graduation, dental schools admit only one class annually and that so far as possible, consistent with local conditions, new classes be admitted in September and graduated in June of the third year thereafter.

Recognizing the possible effects which the emergency may have upon the programs of the dental schools of the United States, the Council urges that all schools in the operation of their courses conform to the principles and criteria set forth in the *Requirements for the Approval of a Dental School.*

The Council also recognizes that an accelerated program will place added financial burdens upon the dental schools and entail hardships for dental students

who depend in whole or in part upon income earned during vacations to maintain themselves in their professional study. The Council proposes to gather data from the schools concerning the volume of the added financial burden which an accelerated program will put upon both schools and students, and will exert every effort to aid the schools in acquainting university presidents and Federal agencies with the financial needs of dental education in the emergency.

COMMITTEE ON DENTAL PREPAREDNESS

THE PREPAREDNESS QUESTIONNAIRE

MUCH confusion concerning the Preparedness Questionnaire has arisen in the minds of the profession, following the articles which appeared in the December 1941 and January 1942 issues of THE JOURNAL.

The questionnaire stressed in these articles is the Preparedness Questionnaire which was authorized by the Board of Trustees at the annual meeting of the American Dental Association in Cleveland in September 1940. It is not in any sense a new activity. The articles were written with the intent of calling the matter to the attention of the delinquents who as yet had not returned a completed questionnaire.

The first mailing of the questionnaire was made in October 1940. Between that time and the date of "Jap Sunday," December 7, 1941, the work of checking all available state lists of dentists had been going forward. Additions and deletions had been made until it was thought that the mailing list was as nearly complete as it was possible to make it. Returned questionnaires were checked against the card list and thus a current check was had on all men who had not made a return.

Immediately after December 7, 1941, another copy of the Preparedness Questionnaire was mailed to each person whose name was on the delinquent list. This mailing was done by first class mail, in order to insure forwarding, and approximately 23,000 questionnaires were sent in this mailing. The returns have been very gratifying, but as yet there are men who have not replied. Further efforts will be made to obtain the cooperation of these men, with the hope that the effort can be successfully terminated.

It is thought that through the operation of the Procurement and Assignment Service, proper use will be made of all professional services. To this end, it is essential that every dentist cooperate in the effort. To date, the only thing which has been asked is that each man complete the Preparedness Questionnaire, and if he has done that, he has done all that has been expected of him.

Later, the Procurement and Assignment Service is to distribute another questionnaire, by means of which each man will be given an opportunity to express his willingness to serve and his choice as to type of service. As this questionnaire will be mailed only to those men who have returned a Preparedness Questionnaire, this matter acquires added significance.

If you have not completed a questionnaire, and all dentists regardless of age, physical condition or connection with any governmental agency should do so, please write to the Central Office and a blank will be forwarded at once. If you have completed a questionnaire, there is nothing further for you to do until the questionnaire from the Pro-

curement and Assignment Service is received, when you should complete and return it at once.

COMMISSIONS IN THE U. S. ARMY DENTAL RESERVE CORPS

As THE JOURNAL goes to press, there has been no change in the matter of applications for commissions in the Dental Reserve Corps of the United States Army. As yet, the Dental Corps Reserve is closed and applications are not being acted upon. With the proposed expansion of the total Army strength, it is anticipated that these regulations will be relaxed in the near future, but it is not known just when this will be.

COMMISSIONS IN THE U. S. NAVY DENTAL RESERVE CORPS

Recently, the regulations governing the application for commissions in the Dental Reserve Corps of the United States Navy have been changed. Applications are now being accepted from men who are not beyond 44 years of age.

To make application for this service, a communication should be directed to the commandant of the naval district in which the applicant resides, or it may be addressed to the Bureau of Medicine and Surgery, United States Navy, Washington, D. C.

AUTOMOBILE TIRE RATIONING

Without doubt, all dentists are by now familiar with the action that has been taken regarding the rationing of automobile tires and tubes.

Immediately following the issuance of the order by which the sale of tires was curtailed except to certain exempt groups, the President of the American Dental Association and the chairman of the Committee on Dental Preparedness addressed the following letter to Mr. Donald M. Nelson, the then director of the Division of Priorities of the Office of Production Management.

December 31, 1941

Mr. Donald M. Nelson, Director
Division of Priorities
Office of Production Management
Washington, D. C.

My dear Mr. Director:

Your office has issued a recent order restricting the purchase of automobile tires only to those persons who have been given a priority rating; namely, "physicians, surgeons, nurses and veterinarians."

The American Dental Association has observed that, perhaps through an oversight, the dental profession was not included in the above named category as eligible to purchase tires necessary for the proper management and control of health needs with respect to dentistry.

Because of the urgency of the problem thus created, your attention is respectfully drawn to a few of the services, both military and civilian, which the profession is rendering and which are necessary to the public health and welfare.

1. All dentists are licensed in the several states as doctors of dental surgery, or doctors of dental medicine, and hold the degree of D.D.S. or D.M.D. given by their respective schools.

2. All but a relatively few dentists perform dental surgery of an extremely technical nature, such as exodontia (extraction of teeth), removal of cysts, root resections and surgical treatment of pyorrhea. The potential dangers necessarily entailed in this type of work subject dentists to twenty-four hour call in order to give prompt and effective treatment for shock, infection, hemorrhage and other dangerous postoperative developments.

3. Because of the great number of automobile accidents, dentists are constantly called upon to treat serious wounds of the face, fractured jaws and other injuries falling within their field and demanding immediate attention.

4. Dentists are assigned to practically all hospital staffs, subject to instant call for emergency duty at any hour. In addition, thousands of dentists are serving in clinics, schools, departments of health and educational institutions.

5. In a great many instances, dentists must travel to the homes or institutions of

sick and aged persons in order to administer proper dental care in the public welfare.

6. From eight to ten thousand dentists are giving freely of their time and energy on selective service boards and advisory and appeal boards, the majority of this work being performed at night. Many are also serving on state and local committees appointed by the Procurement and Assignment Service and on state and local military affairs committees of the respective dental societies.

7. Because of the War, population centers are radically shifting, often requiring that dentists shall divide their services between two locations—the original office and the defense area. In many sections, it is normally customary for dentists to practice in more than one place in order to give service, including orthodontia and other dentistry for children. That dental service in defense areas is a problem of major consideration is evidenced by plans now being considered by the Procurement and Assignment Service, created by the President, to enlist the services of dentists for this work. It is probable that dentists located within a radius of 25 to 50 miles will be called upon to render some, and perhaps all, of the service in these localities.

8. The full impact of the war has not yet been felt, and probably will not be realized for some time. However, in the event of air raids, dentists will be needed to augment and assist in the work of physicians and surgeons. The American Red Cross has recognized the value of dental service in such situations by placing a dentist on every disaster committee in the nation. Moreover, dentists everywhere are taking refresher courses in first-aid and emergency technics in order to be of the greatest possible assistance whenever and wherever they may be needed.

In view of the foregoing considerations, the American Dental profession is of the opinion that a great disservice and injustice to public welfare may result from inadequate transportation facilities. It is therefore respectfully suggested that the recent priority order with respect to automobile tires be so modified or amended, or construed, as to include dentists. Such action would afford the profession an opportunity to continue its policy of meeting the exigencies of the emergency with as complete a military and civilian health service as is possible.

Your earnest consideration of the above suggestions will be appreciated by the entire profession, and you may be assured of the profession's conscientious cooperation in the decision that is made.

Very sincerely,
OREN A. OLIVER, *President,*
American Dental Association.
C. WILLARD CAMALIER, *Chairman,*
Committee on Dental Preparedness.

January 14, 1942, the following letter was received at the Central Office of the American Dental Association in reply to the foregoing letter.

Office of Price Administration
Washington, D. C.

January 9, 1942
Refers to 2:12:BWL

American Dental Association
Chicago, Illinois
Gentlemen:

Thank you for your letter of December 31, 1941.

This office fully appreciates the inconvenience and in many cases the very real hardship that will be caused by the tire shortage to those whose profession requires automobile travel.

While I am unable to offer any substantial hope that it will be possible in the near future to amend the regulations to allow purchase of new tires by members of your group, I want you to know that the problem raised by your letter is receiving very serious and continuing study. We shall be guided by experience under the regulations and by developments affecting the flow of crude rubber supplies from the Far East. You may be sure that the restrictions will be relaxed at the earliest date compatible with our national security.

At the present time, there are no restrictions on the purchase of used or retreaded tires. This may help to ease the difficulty faced by you and others in your position.

Sincerely yours,
J. K. GALBRAITH,
Assistant Administrator.
By BEN W. LEWIS,
Price Executive.
Rubber and Rubber Products Section.

It is to be noted that in his reply Mr. Lewis states that "we shall be guided by experience under the regulations. . . ." Any dentist whose health service to the civilian population or to the defense industries is being curtailed or is in danger of being curtailed by the exclusion of dentists from the tire-rationing program should address a letter to Mr. Lewis in order to acquaint him with the facts concerning the curtailment.

C. WILLARD CAMALIER, D.D.S.,
Chairman,

GERALD D. TIMMONS, D.D.S.,
Secretary.

DENTAL STUDENTS AND INSTRUCTORS

UNDER date of January 12, 1942, General Lewis B. Hershey, Director of Selective Service System, issued a Memorandum to all State Directors and Local Boards, regarding occupational deferments, being a supplement to Memorandum 1-62, 1-91, 1-99 and 1-150.

The Committee on Dental Preparedness quotes below paragraphs pertinent to the status of dental students and instructors which can be used freely by Deans and others in requesting deferment for individuals falling within these categories. It is believed that local boards will follow the principles laid down in General Hershey's memorandum in order that the flow of professional personnel may continue and thus insure for the future sufficient numbers for our greatly expanding armed forces.

The attention of local boards is again invited to the necessity of seriously considering for deferment students in certain specialized professional fields in which dangerously low levels of manpower are found to exist. This memorandum is in addition to and does not rescind those previously issued which apply to students in other critical fields.

Subsequent to the declaration of war, local Selective Service agencies have in many instances proceeded to classify registrants without regard to the fact that they are in training or preparation for activities, the maintenance of which is essential to the national health, safety, or interest, and war production. This is particularly true in cases of engineering, chemical, physics, medical, and *dental students.*

Admittedly there is an overlapping of the military and civilian requirements of a nation at war; however, it must be borne in mind the one is dependent upon the other. It is estimated that the expanding Army will eventually require doctors and dentists in numbers heretofore unknown. They will not be available if those students who show reasonable promise of becoming doctors and dentists are inducted prior to becoming eligible for commissions.

It is equally important that instructors in these fields be seriously considered for occupational deferment. Shortages of qualified instructors are known to exist. The educational institution employing the instructor should be requested to file DDS Form 42A in all cases where deferment is sought.

In considering student deferment cases, certain local boards are requiring the execution of DSS Form 42A in addition to the affidavit of the college or university contained in Bulletin No. 10 issued by the American Council on Education. DSS Form 42A should not be required where the American Council on Education affidavit has been submitted.

Local Boards will be informed when the manpower requirements necessary to the national health, safety, or interest, and war production become static. Until such time, the policy set forth in the Memoranda to All State Directors 1-62, 1-91, 1-99, and 1-150 remains in force.

RESEARCH COMMISSION

EXCESSIVE EXPANSION OF AMALGAM

THE Secretary of the Research Commission has received the following communication from the Director of the National Bureau of Standards. In view of the importance of this information, the Commission considers it worth while to publish the letter and the article in their entirety.

December 15, 1941

Dr. Daniel F. Lynch, Secretary,
Research Commission, A. D. A.,
1678 Primrose Road, N. W.,
Washington, D. C.

Subject: Amalgam

Dear Dr. Lynch:

Earlier in the year, we forwarded a preliminary statement regarding the dangers to be expected from palming dental amalgam. You very promptly and quite properly printed the announcement in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, promising a more detailed report later.

This Bureau had expected to be able to send the completed report before the end of the year. However, urgent requests for data on other tests have made it impossible to complete the report during the remainder of the year 1941.

In the November issue of the *Technical News Bulletin*, we gave a brief announcement of further details for the benefit of those wishing to pursue the technical phases of the problem.

It is thought that you may wish to give these all too brief technical details to the Association. If so, the enclosed copy, prepared by the Research Associates and Bureau workers, will aid you in presenting all that it is possible to release in the year 1941.

As time permits, we shall give attention to the preparation of THE JOURNAL report, giving curves, data, etc.

Respectfully,
LYMAN J. BRIGGS, *Director*.

EFFECTS OF PALMING AMALGAM

Further investigation by Souder, Beall and Schoonover[1] at the National Bureau of Standards explains their discovery that the excessive expansion observed in some amalgams is caused by the presence of moisture and sodium chloride (both ingredients of perspiration) introduced into the mix during amalgamation.

These investigators have been able to demonstrate that the expansion is accompanied by the formation of hydrogen gas; undoubtedly, by a reaction between zinc, water and salt within the specimen.

Specimens of a zinc-containing amalgam (not contaminated during mixing) placed in the sodium chloride solution, after they have been properly condensed and set, do not show excessive expansion. Hydrogen was not detected in alloys which did not contain zinc. This explains the recent data published by Sweeney[2] showing that non-zinc alloys give no clinical evidence of "distortion." It is feared that Sweeney's statement "all of the non-zinc restorations give no clinical evidence of distortion" may cause some dentists to miss the true theme of these researches.

If we remember that excessive expansion is the result of contamination, we shall see that the dentist's problem is one of cleanliness throughout all operative procedures rather than the selection of a special alloy. Neither the Research Commission nor the National Bureau of Standards has data showing any superiority, structurally or clinically, of non-zinc alloy over zinc-containing alloy when properly handled. It must be re-

1. Palming Amalgam. J.A.D.A., 28:830, May 1941.

2. SWEENEY, J. T.: Delayed Expansion in Non-Zinc Alloys. J.A.D.A., 28:2018, December 1941.

membered that of the sixty-four alloys on the list of Certified Amalgam Alloys, not one is of the non-zinc type. Furthermore, these alloys have given good service.

Those wishing to demonstrate the presence or absence of gas in a test specimen may do so by placing the test specimen, after twenty or thirty days, in a beaker of water and heating the water slowly to near the boiling point. As the heat begins to soften the amalgam, the gas will break through and escape at the surface of the specimen. In some instances, this gas will begin to escape at body temperature. A few bubbles will form on most specimens as a result of air or volatile material adhering to the surface. Entrapped hydrogen, if present, will push out through the amalgam and escape in numerous bubbles. The amalgam will, when sectioned, show the voids in which the gas was trapped.

Those wishing to make a more extensive study of the effects of moisture and salts, used as contaminants of dental amalgams, may do so by crushing a contaminated specimen 20 days old under water. The entrapped gas will be liberated and may be collected for such further qualitative or quantitative study as is desired.

Sufficient data are now at hand to cast doubt upon a number of reports by other investigators who have attempted to explain excessive and delayed expansion in terms of factors other than contamination and gases generated therefrom.

Data and details of the research are being prepared for early publication in THE JOURNAL. Quantitative tests of the amount of hydrogen liberated, an estimate of the pressure within the specimen, a theory as to the origin of the gas and curves showing the enormous expansion of some alloys contrasted with the stability of clean alloys will be presented.

In view of the information contained in this communication from the Bureau, the Commission believes that it should repeat its warning concerning the dangers of contaminating amalgam by palming.[1]

M. D. HUFF, *Chairman,*
DANIEL F. LYNCH, *Secretary,*
Executive Board, Research Commission.

LISTS OF CERTIFIED DENTAL MATERIALS

(As of December 1, 1941)

THE A.D.A. Research Commission, in cooperation with the National Bureau of Standards, has developed specifications for the following materials: amalgam, inlay investment, impression compound, inlay casting wax, inlay casting gold alloy, mercury, wrought gold wire, zinc phosphate cement, silicate cement and hydrocolloidal impression materials.

Samples of the foregoing materials which were certified to the Research Commission by the various manufacturers as complying with the A.D.A. specifications were procured on the retail market by the Research Commission and were tested by the A.D.A. Research Associates at the National Bureau of Standards. The following certified materials were found to comply with the A.D.A. Specifications. Certified materials which did not comply with specifications are omitted from the lists.

Materials listed below are constantly being tested. Therefore, the lists are subject to revision from time to time. The revised lists will be published in the JOURNAL.

In purchasing certified materials for use in your practice, these lists should be used as a buyer's guide. In addition, the package of material received should be checked for its exact name as given

in the lists, and for a statement guaranteeing compliance with the specification. The last step is recommended, because there are several instances in which the manufacturer of a certified product also makes materials of the same kind that do not meet the requirements of the specification and are not certified. For example, "X" Green Wax-Medium may be on the list of certified waxes, but "X" Green-Soft and "X" Green-Hard do not meet the requirements of the specification.

Unless deliveries of such materials are carefully checked, one can easily accept the wrong material.

CERTIFIED AMALGAM ALLOYS (A.D.A. SPECIFICATION NO. 1.)

Alloy	Manufacturer and Distributor
Accurate Metalloy (filings)	The L. D. Caulk Co.
Ackerman (filings)	Ackerman Dental Mfg. Co.
Argentum ("A" cut)	Hammond Dental Mfg. Co.
Argentum (fine cut)	
Argentum (medium cut)	
Argentum (shavings)	
Aristaloy	Baker & Co., Inc.
Banner (filings)	Goldsmith Bros. S. & R. Co.
Blue Diamond (filings)	Reliance Dental Mfg. Co.
Brewster Medium (shavings); Quick (filings); Quick (shavings)	E. R. S. Brewster
Capeako (filings)	Precious Metals Refining Works
Certified	Lee S. Smith & Son Mfg. Co.
Coe	Coe Laboratories, Inc.
Cresilver	Crescent Dental Mfg. Co.
Dee (filings)	Thomas J. Dee & Co.
Diamond Edge	Young-Baker & Co.
Excel	Daniels Dental Alloy Co.
Fellowship, New	Dental Protective Supply Co.
Fleck's	Mizzy, Inc.
Garfield's	Garfield Smelting and Refining Co.
Gold Bond	Jefferson Laboratories
Lustraloy, Regular	A. Pfingst
Lustraloy Cut T	
Minimax (filings) 173, 177, 178, 183, (shavings) 177, 178	The Minimax Co.
Minimax White Gold & Platinum	
Mission No. 5	Henry F. Bruce Co.
Mission No. 5 ("A" cut)	
Mission No. 6	
Modeloy (Quick Setting) (filings)	Crescent Dental Mfg. Co.
Moyco Higrade	The J. Bird Moyer Co.
Mynol Improved	Mynol Chemical Co.
New Deal	Miller Dental Co.
Ney-Aloy	The J. M. Ney Co.
Ney's No. 125	
Odontographic "Improved" (filings)	Odontographic Mfg. Co.
Pearlol	Wildberg Bros. S. & R. Co.
Preferred C	Precious Metals Refining Works
Preferred D	
Research Oralloy	Precious Metals Research Work, Inc.
Royal Special—First Setting	Garhart Dental Specialty Co.
Royal Super—First Setting	
Silver Crown	General Refineries, Inc.
Silver Crown (medium)	
Silverloy (filings), Silverloy (shavings)	Crescent Dental Mfg. Co.
Speyer	Speyer Smelting & Refining Co.
S-C Medium (filings); S-C Quick (filings)	Stratford-Cookson Co.
S-R	Lee S. Smith and Son Mfg. Co.

Standard	Standard Dental Products Co.
True Dentalloy (filings)	The S. S. White Dental Mfg. Co.
True Dentalloy (cut "A")	
Twentieth Century (regular)	The L. D. Caulk Co.
Twentieth Century (special)	
Uniform	Henry Nelms & Son
Vertex	Vertex Dental Products Co.
White Beauty	Lang Dental Mfg. Co.

CERTIFIED INLAY CASTING INVESTMENTS (A.D.A. SPECIFICATION No. 2.)

Investment	Manufacturer or Distributor
Coecal Inlay	Coe Laboratories, Inc.
Coecal Universal	
Kerr Cristobalite-Inlay	Kerr Dental Mfg. Co.
Ransom and Randolph Gray	The Ransom & Randolph Co.
Ransom and Randolph Green	
S. S. White Inlay No. 20	The S. S. White Dental Mfg. Co.
Security Improved Inlay	The Cleveland Dental Mfg. Co.
Steele's-Super	The Columbus Dental Mfg. Co.

CERTIFIED IMPRESSION COMPOUNDS (A.D.A. SPECIFICATION No. 3.)

Compound	Type	Manufacturer or Distributor
Certified	I	Lee S. Smith & Son Mfg. Co.
Kerr Perfection	I	Kerr Dental Mfg. Co.
Kerr No. 2 Soft Green	I	
Mizzy—Low Heat	I	Mizzy, Inc.
S. S. White—Black—Tray	II	The S. S. White Dental Mfg. Co.

CERTIFIED INLAY CASTING WAXES (A.D.A. SPECIFICATION No. 4.)

Wax	Manufacturer or Distributor
Caulk-Blue	The L. D. Caulk Company
Kerr-Blue—Hard	Kerr Dental Mfg. Co.
Maves Green	The Heidbrink Co.
Security	The Cleveland Dental Mfg. Co.
Sterling	Baker & Co., Inc.
Taggart's Green	Mizzy, Inc.

CERTIFIED INLAY CASTING GOLD ALLOYS (A.D.A. SPECIFICATION No. 5.)

Alloy	Type*	Manufacturer or Distributor
Aderer-A-Soft	A	Julius Aderer, Inc.
Aderer-B-Medium	B	
Aderer-C-Hard	C	
Baker Inlay Soft	A	Baker & Co., Inc.
Baker Inlay Medium	B	
Baker Inlay Hard	C	
Bruce "A"	A	Henry F. Bruce Co.
Bruce "O"	B	
Bruce No. 1	A	
Bruce No. 2	B	
Bruce No. 3	C	
Bruce No. 5	C	
Chilcast No. 1	A	Vernon-Benshoff Co.
Chilcast No. 1-A	B	
Chilcast No. 2	C	
Chilcast No. 2-A	B and C	
Crown Inlay No. 2—Soft	A	General Refineries, Inc.
Crown Inlay No. 1—Hard	B	
Crown No. 9	C	
Crown K	A	
Crown Knapp No. 2	B	
Crown Knapp No. 3	C	
Crown Supreme Inlay	C	
Crown T	B	
Crown TT	C	

Deeone	A	Thomas J. Dee & Co.
Deetwo	B	
Deesix	C	
Dressel	C	Julius Aderer, Inc.
Goldsmith Inlay No. 1	A	Goldsmith Bros. S. & R. Co.
Goldsmith Inlay No. 2-Medium	B	
Goldsmith Inlay No. 3-Hard	C	
Jelenko Alboro Inlay	C	J. F. Jelenko & Co., Inc.
Jelenko Durocast	C	
Jelenko Firmilay	C	
Jelenko Modulay	B	
Jelenko Platin-Cast	B	
Jelenko Special Inlay	A	
Lite Wite Inlay	C	Precious Metals Research Works, Inc.
Lite Wite Hard Inlay	C	
Mowrey B Inlay	B	W. E. Mowrey Co.
Mowrey-Special Inlay	C	
Mowrey T Gold	B	
Mowrey TT	C	
Nelms E	B	Henry Nelms & Son
Nelms F	A	
Nelms J	C	
Ney-Oro A	A	The J. M. Ney Co.
Ney-Oro AA	A	
Ney-Oro A-1	B	
Ney-Oro A-10	B	
Ney-Oro B	C	
Ney-Oro B-2	C	
Research-A-Soft	A	Precious Metals Research Works, Inc.
Research-B-Medium	B	
Research-Inlay	C	
Research-Hard Cast No. 5	C	
Spyco Hard	B	Spyco Smelting and Refining Co.
Spyco Soft	A	
Spyco No. 6	C	
S. S. White No. 1	B	The S. S. White Dental Mfg. Co.
S. S. White No. 2	A	
S. S. White No. 5	B	
S. S. White No. 8	C	
S. S. White No. 13	C	
S. S. White No. 31 Metalba	B	
S. S. White No. 820	B	
S. S. White No. 860-Hard	C	
S. S. White No. 900	A	
S. S. White No. 940	A	
Stern A-7 (No. 2381)	C	I. Stern and Co.
Stern No. 2847	C	
Stern No. 3290	B	
Stern No. 3337	C	
Stern No. 3375	A	
Stern No. 3441	C	
Stern No. 3465	B and C	
Stern No. 6219	B	
Stern H (No. 6485)	C	
Tinker No. 1	B	Spyco Smelting and Refining Co.
Tinker No. 1H	C	
Tinker No. 2	C	
Tinker Inlay	B	
Wildberg "A"	B	Wildberg Bros. S. & R. Co.
Wildberg "C"	C	

Williams-Klondiker	C	The Williams Gold Refining Co., Inc.
Williams No. 3	A	
Williams-Pioneer	B	
Williams Special "Four"	C	
Williams Special Inlay	B	
Williams Will-Cast 22	A	

*Relative hardness: A, soft; B, medium; C, hard

CERTIFIED DENTAL MERCURIES (A.D.A. SPECIFICATION No. 6.)

Mercury	Manufacturer or Distributor
Argentum	Hammond Dental Mfg. Co.
Chemically Pure	The S. S. White Dental Mfg. Co.
Crown	General Refineries, Inc.
Dee	Thomas J. Dee & Co.
Dental	Goldsmith Bros. S. & R. Co.
Excel	Daniels Dental Alloy Co.
Fellowship	Dental Protective Supply Co.
Garfield's	Garfield S. & R. Co.
Garhart's Positively Pure	Garhart Dental Specialty Co.
Krause's Pure	Krause Gold Refineries
Mercury Laboratories	Mercury Laboratories, Inc.
Minimax	The Minimax Co.
Mission	Henry F. Bruce Co.
Moyco	The J. Bird Moyer Co.
Mynol	Mynol Chemical Co.
Ney's C. P.	The J. M. Ney Co.
Odontographic	Odontographic Mfg. Co.
Research	Precious Metals Research Works, Inc.
R. P. C.	Research Products Corporation
Spectropure	Baker & Co., Inc.
Twentieth Century	The L. D. Caulk Co.
Williams	The Williams Gold Refineries Co., Inc. (Applies to Williams' one pound bottles only, as quarter pound containers are not glass.)

CERTIFIED WROUGHT GOLD WIRE ALLOYS (A.D.A. SPECIFICATION No. 7.)

Alloy	Manufacturer or Distributor
Aderer No. 1	Julius Aderer, Inc.
Aderer No. 3	
Aderer No. 4	
Aderer No. 20 Clasp	
Baker Q. A.	Baker & Co., Inc.
Crown Hylastic	General Refineries, Inc.
Deepep-Hard	Thomas J. Dee & Co.
High Fusing Clasp	Goldsmith Bros. S. & R. Co.
Jelenko No. 3 Wire	J. F. Jelenko & Co., Inc.
Jelenko Super Wire	
Medium Clasp	Goldsmith Bros. S. & R. Co.
Ney-Oro Elastic No. 4	The J. M. Ney Co.
Neydium 9	
Regular Clasp	Goldsmith Bros. S. & R. Co.
Spyco No. 3	Spyco Smelting and Refining Co.
Spyco No. 4	
Stern No. 2657	I. Stern and Co., Inc.
S. S. White No. 12	The S. S. White Dental Mfg. Co.
S. S. White No. 61 Metalba	
Williams No. 1 Super	The Williams Gold Refining Co.
Williams No. 2 High Fusing Clasp	
Williams No. 3 High Tensile	

CERTIFIED ZINC PHOSPHATE CEMENTS (A.D.A. SPECIFICATION NO. 8, First Revision)

Cement	Manufacturer or Distributor
Ames Z-M	The W. V-B Ames Co.
Bosworth's Zinc	Harry J. Bosworth Co.
Caulk Crown and Bridge	The L. D. Caulk Co.
Caulk Petroid Improved	
Caulk Tenacin	
Certicem	Lee S. Smith and Son Mfg. Co.
Fleck's Extraordinary	Mizzy, Inc.
Lang Dental Crown Bridge and Inlay	Lang Dental Mfg. Co.
Moyco Adamant	The J. Bird Moyer Co., Inc.
Moyco Inlay Crown and Bridge	
Moyco White Copper	
S-C	Stratford-Cookson Co.
Smith's	Lee S. Smith and Son Mfg. Co.
S. S. White Silver "A"	The S. S. White Dental Mfg. Co.
S. S. White Silver "B"	
S. S. White Zinc	
S. S. White Zinc, Improved	

CERTIFIED SILICATE CEMENTS (A.D.A. SPECIFICATION NO. 9.)

Cement	Manufacturer
Ames Plastic Porcelain	The W. V-B Ames Co.
Astralit	Premier Dental Products Co.
Baker Plastic Porcelain	Baker & Co., Inc.
DeTrey's Synthetic Porcelain	The L. D. Caulk Co.
Durodent Enamel	Oskar Schaefer
Smith's Certified Enamel, Improved	Lee S. Smith & Son Mfg. Co.
S. S. White Filling Porcelain, Improved	The S. S. White Dental Mfg. Co.

CERTIFIED HYDROCOLLOIDAL IMPRESSION MATERIALS (A.D.A. SPECIFICATION NO. 11.)

Material	Manufacturer or Distributor
Deelastic	Thos. J. Dee and Co.
Dentocoll	The L. D. Caulk Co.
Kerr Hydro-Colloid	Kerr Dental Mfg. Co.
Perfectocoll	Baker & Co., Inc.
Plasticoll	Lee S. Smith & Son Mfg. Co.
S. S. White Elastic Colloid	The S. S. White Dental Mfg. Co.
Surgident	Surgident, Ltd.

CERTIFIED DENTURE RESINS (A.D.A. SPECIFICATION NO. 12.)

Material	Form	Certified by
B-B	Clear, powder-liquid	Bell Dental Products Co.
B-B	Pink, powder-liquid	Bell Dental Products Co.
Densene	Clear, powder-liquid	Cosmos Dental Products, Inc.
Densene	Pink, powder-liquid	Cosmos Dental Products, Inc.
Lucitone	Clear, plastic cake	The L. D. Caulk Co.
Lucitone	Clear, powder-liquid	The L. D. Caulk Co.
Lucitone	Pink, plastic cake	The L. D. Caulk Co.
Lucitone	Pink, powder-liquid	The L. D. Caulk Co.
Luxene 44	Pink, plastic cake	Luxene, Inc.
Stryker's	Pink, powder-liquid	Stryker's Dental Products, Inc.
Vernonite	Clear, plastic cake	Vernon-Benshoff Co.
Vernonite	Pink, plastic cake	Vernon-Benshoff Co.
Vernonite	Pink, powder-liquid	Vernon-Benshoff Co.
Vita-Lite	Pink, powder-liquid	Vita-Lite Products Co.

COMMITTEE ON ECONOMICS

DENTAL SERVICE IN INDUSTRY

SEVERAL years ago, an allied organization of the American Dental Association under the direction of E. L. Pettibone made an investigation to determine the extent of dental participation in health activities carried on by industrial concerns in this country. As a result of this investigation, a file was built up of industries having some form of dental program for their employes.

This file of dental programs in industry was brought up to date in 1939 by the Committee on Dental Economics of the American Dental Association. In addition, a survey was made of the nature of these dental programs and of the types of service offered.

The findings of this survey confirmed the opinion of the Committee on Dental Economics that standards for dental service in industry should be established. In 1936, the American Medical Association authorized the formation of a council on industrial health, which held its first meeting in 1939. At this meeting, the Council adopted a minimum standard for medical service in industry. The Council on Industrial Health employs a full-time secretary to conduct the activities of the Council.

From time to time, the Committee on Dental Economics has received inquiries from industries interested in establishing some form of dental service. Groups of employes in industry have appealed to this Committee for advice in establishing a dental program. Members of the dental profession, also, who have been approached either by employers or employes or by both in regard to establishing a dental program have come to the American Dental Association for guidance.

The United States Public Health Service has evinced an interest in having dentistry take its part in lowering infection due to industrial hazards. At the meeting of the American Dental Association in Cleveland, Ohio, in 1940, the American Association of Public Health Dentists discussed the problem and urged the continuance of investigation in this field.

As industry swings into increased speed, as necessitated by the National Defense Program, new health hazards will arise. The need for the greater participation by the dental profession in programs to control industrial hazards to health is great.

To the end that the position of the dental profession shall be strengthened in the industrial field and that industry may be guided in its desire to protect its workers and to assist the United States Public Health Service in its efforts to aid in the National Defense Program, the Committee on Dental Economics proposes "A Minimum Standard for Dental Service in Industry."

During their formulation, these standards were on two occasions submitted, as various changes were made, to the Board of Trustees and Officers of the American Dental Association, to officers of the component societies, to members of the American Association of Public Health Dentists, to the chairmen of all standing committees, to the Committee on Preparedness and to the National Health Program Committee, as well as to the members of the Committee on Economics and to their deputies.

At the meeting of the National Health Program Committee, October 25, 1941, the standards as drawn up by the Committee on Economics were unanimously approved.

On the basis of the suggestions and

criticisms received from these groups, a final draft of the proposed Minimum Standards for Dental Service in Industry was accepted and ordered transmitted to the Board of Trustees, urging that they take immediate and favorable action to the end that these standards might be presented to the House of Delegates for action.

The standards were approved by the Board of Trustees and were presented to the House of Delegates October 30. The standards were adopted by the House of Delegates without a dissenting vote. These standards, which are now in operation, represent the position of the American Dental Association in regard to the organization and operation of dental programs in industrial establishments. A copy of the standards as approved is given herewith.

A MINIMUM STANDARD FOR DENTAL SERVICE IN INDUSTRY

The American Dental Association recognizes the need for better organization and service in caring for the ill and injured in industry. Since the maintenance of oral health has an important effect upon the physical well-being of the individual, well-organized industrial medical programs should include dental care as an integral part of their facilities. Dental defects and dental infection are not only a potential cause of sickness and loss of time, but they also may be directly related to laxness in concentration on the industrial operation and may be a potential cause of accidental injuries.

The dental profession believes that the state and the local society, in collaboration with the division of dental hygiene of the state department of health, is best qualified to plan and organize a program to meet the needs of the industrial group in a particular community. Consequently, the profession holds that it is incumbent upon the industrial concern contemplating the establishment of a dental program for its employes to consult with the local dental society. Furthermore, in order to establish the most effective program, the dental profession holds that a plan of continuing cooperation with the local dental society should be instituted.

Any further extension of an industrial dental service beyond the scope of the attached rules shall await the further exploration of these fields by the Committee on Economics of the American Dental Association and the specific authorization of the state dental society with reference to state laws and rights.

ESSENTIALS OF AN INDUSTRIAL DENTAL SERVICE

1. The industrial establishment shall have an organized dental service, as further specified, with a competent staff including consultants and with adequate facilities to insure efficient care of all employes who need palliative emergency dental treatment because of occupational injuries or who have developed oral manifestations of occupational disease.

2. The dental department shall urge all employes to obtain necessary dental treatment and shall devote a portion of its time to educating them in the value of maintaining oral health.

3. The industrial establishment shall require thorough mouth examination of all persons entering employment. There shall be a system of complete and accurate records, filed in an accessible manner and available to the employe, to medical and dental services, and to government agencies for identification purposes. In setting up the records to be maintained, the division of dental hygiene of the state department of health should be consulted in order that a uniform system of dental records may be developed that will make possible valuable statistical analyses and comparisons.

4. Membership on the dental staff shall be restricted to dentists who are (a)

in good standing with the local dental society, and (b) qualified in such fields as may be included within the service.

5. The dental department or service shall have complete responsibility for the dental personnel as to the quality of service rendered.

6. Industrial dentists should be familiar with the industrial processes and watch closely for evidence of oral disease caused by such poisons as mercury, lead, phosphorus, fluorine, acids and radioactive materials, and of other chemical or physical hazards. Immediately upon noting any oral evidence of occupational disease, other units in the industrial establishment, such as the medical department or safety engineering department, should be notified, to the end that cooperative study and action may be undertaken.

7. The industrial dental service shall limit itself to the services specifically mentioned above. X-ray and prophylactic services in newly established industrial dental programs, however, and all details (not included in paragraphs one through six) of services in operation at the time of the adoption of these rules shall require merely the approval of the state dental society.

Mimeographed copies of the essentials are available upon request to the secretary of the Committee on Economics, American Dental Association, 212 East Superior St., Chicago, Ill.

R. M. WALLS, D.D.S., *Chairman,*
M. L. DOLLAR, *Secretary.*

COMMITTEE ON LEGISLATION

THE DENTIST'S FEDERAL INCOME TAX—1942

ALL federal income tax returns must be made on or before March 15, 1942, unless an extension of time has been granted by the district collector of internal revenue. Penalties are imposed for failure to make a tax return, making a false or fraudulent return or failure to file a return on time.

The 1941 Revenue Act made several important changes in the federal income tax laws. The personal exemption for single persons was lowered from $800 to $750 and for married persons from $2,000 to $1,500. This means that if you are single and your gross income was over $750 for the calendar year 1941, you must file a return. If you are married and lived with your wife (or husband) for any part of the year and your gross income for the year was $1,500 or over, you must file a return. The number of dependents is immaterial for filing purposes. You must file a return if your gross income was $1,500 or more even if you will have no tax to pay because of your credits for dependents.

DEFINITION OF TERMS

Gross Income.—The gross income of a dentist includes the total amount received by him for professional services during the taxable year. All income must be included even though it may cover money received for professional services rendered in preceding years. Gross income also includes any sums received as profits from investments or income from any other source.

Net Income.—The net income is the amount remaining after "deductions" such as professional expenses, contributions and taxes have been made from the gross income. The net income is the amount upon which the income tax is paid.

Earned Income.—Earned income includes professional fees, salaries and wages received for personal services as distinguished from money received from investments and other sources.

FORMS USED FOR RETURNS

The 1941 amendments to the income tax law authorized the use of a new tax return form in addition to the old form. This means that two forms will be used —Form 1040, which may be called the "regular form," since it has been in use for many years, and Form 1040A, which is called the "optional form" and was devised in connection with the new law. Form 1040A was designed for the use of salaried persons making less than $3,000 a year. It is considerably less complex than Form 1040 and therefore less difficult to fill out. Since the average salaried person has very few deductions to make, Form 1040A does not provide for deductions and the taxpayer determines the amount of his tax by first determining his gross income and then looking it up on a chart attached to the return which shows how much tax a person with that income must pay.

Form 1040A is not for the use of dentists in private practice because deductions play an important part in the determination of how much income tax the dentist must pay. Dentists are permitted to make many deductions which salaried persons cannot. Most of the important deductions which dentists are authorized to make are covered in the following paragraphs.

DEDUCTIONS FOR PROFESSIONAL EXPENSES

The dentist who is required to file a return is entitled to deduct from his gross income all current expenses necessary to carrying on his practice. Because the taxpayer may be required to show proof of the expenditure which he has deducted, he should maintain adequate records of all expenses, including invoices, receipts and similar evidences of payment. These records should be kept for several years after the tax is paid, as a dispute might arise which could best be settled by referring to these records. Among the office expenses which are currently deductible are the following:

Rent.—The dentist may deduct the amount of his office rent. If the office is used for professional purposes entirely, he may deduct the entire rent. If his office is in a building which he rents and uses for a residence also, he may deduct an amount which is fairly proportionate to the amount of space used for his office. He cannot deduct any part of the rent of his house or apartment merely because he occasionally sees a patient there. He cannot charge himself with rent if he owns the building in which his office is located.

Office Maintenance.—Office maintenance expenses may be deducted from gross income as professional expenses, and this includes such things as heat, light, gas, laundry and telephone.

Salaries.—All of the salaries which must be paid in order to conduct the practice are deductible expenses. These would include salaries of assistants, hygienists, technicians, receptionists or other employees.

Office Supplies.—The cost of office supplies may be deducted from the gross income. Office supplies include the various articles used in a dentist's office which are consumed in the using. Under this heading would come drugs, chemicals, filling materials, such as gold and alloys, cotton rolls, burs, polishing disks and mandrels. Also included in this category are laboratory fees.

Machines and Heavy Equipment.—The remainder of the equipment commonly used in a dental office is of a more permanent nature and its total cost cannot be deducted as expense in the year of its purchase. These articles do wear out and depreciate in value, however, and it is permissible to deduct a

portion of the cost each year that it is in service. The amount that can be deducted depends on the nature of the article, the character of its use and the circumstances of the particular case.

One thing that must be remembered in determining the rate of depreciation is that the total amount claimed as depreciation during the life of the article, plus the salvage value of the article at the end of its useful life, must not be greater than its purchase price, or if purchased before March 1913, either its fair market value as of that date or its original cost, whichever may be greater. As the depreciation rate does not necessarily have to be uniform, if it becomes evident that a rate which has been used for some years will fully depreciate the cost minus salvage price, before the article will become useless, it would be wise to reduce the rate of depreciation.

The burden of proof rests upon the taxpayer in sustaining the deduction claimed. Therefore, taxpayers must be prepared to furnish full and complete information with respect to the cost of the assets in respect to which depreciation is claimed, their age, condition and remaining useful life, the portion of the cost which has already been deducted and such other information as the commissioner may require.

Depreciation allowances claimed by the taxpayer should be recorded on the taxpayer's books either by a direct deduction from the book value or by establishing a reserve account.

While there may be considerable variation in individual circumstances the following are considered normal or average rates of depreciation: ordinary dental libraries, x-ray equipment, dental units, sterilizers, surgical instruments and diagnostic apparatus, 10 per cent a year; office furniture, 5 per cent a year.

Dues.—Dues to professional societies and subscriptions to professional journals may be deducted from gross income.

Dental Meetings.—Expenses incurred in traveling, including amounts paid for transportation, meals and lodging, necessarily incurred in attending dental meetings for a professional purpose, and expenses necessarily incurred in professional visits may be deducted. The expense of attending a postgraduate course or clinic has been ruled non-deductible.

Automobile.—Expenses paid in the operation and repair of an automobile used in making professional calls are deductible. This does not mean that a dentist using a car merely to go to and from his office or offices is entitled to deduct the expense of maintaining the automobile, since this is regarded as using it merely for personal convenience.

Moving Expense.—Expenses incurred in transferring one's professional office are deductible.

Entertaining Expenses.—If necessary for increasing clientele, entertaining expenses are deductible.

Periodicals.—The cost of magazines and newspapers purchased for waiting patients and kept in the waiting room may be deducted.

Contributions.—Gifts to charitable organizations are in general deductible from gross income, but detailed information should be obtained from a collector of internal revenue or some other reliable source.

Losses.—Losses caused by a fire, theft or other happening are fully deductible if they are not compensated for by insurance or otherwise. In general, losses for which an amount may be deducted from gross income must be evidenced by closed and completed transactions, fixed by identifiable events, bona fide and actually sustained during the taxable period for which allowed.

Insurance Premiums.—Premiums paid for insurance against professional losses may be deducted. This includes insurance against fire, storm, theft, accident and malpractice or other similar professional losses.

Legal Expense.—The expense of de-

fending a malpractice suit may be deducted as a professional expense.

Taxes.—The taxes imposed on employers by the Social Security Act (old age benefits and unemployment insurance) may be deducted annually from the employer's gross income. Employes, including dentists whose employment brings them within that category, may not deduct the tax imposed upon their income as wages for old age benefits under the Social Security Act. However, if the dentist as the employer does not deduct the amount of the tax from the employe's wage, but assumes the payment of the tax himself, he may deduct the amount of the tax, not as tax paid, but as an ordinary business expense resulting in increased compensation to his employes.

RECENT COURT DECISIONS

DENTAL PRACTICE ACTS: SUSPENSION OF LICENSE FOR ADVERTISING PROFESSIONAL SUPERIORITY

A SECTION of the Business and Professions Code of California authorizes the Board of Dental Examiners to suspend or revoke the license of a dentist guilty of unprofessional conduct, which, among other things, is defined to include "the advertising of professional superiority or the performance of professional services in a superior manner." Proceedings were instituted against Barron, a licensed dentist, before the board, charging that he had so advertised in that he caused to be published in the Oakland telephone directory an advertisement which, among other things, stated: "His 'Naturally Beautiful' Plates, combined with 'Facial Reconstruction' in designing, makes him Oakland's leading Plate Dentist." After notice and hearing, the board suspended his license and Barron sought a writ of mandate to require the board to set aside its order of suspension. The trial court denied the writ and Barron appealed to the district court of appeal, first district, division 2, California.

Barron alleged that the action of the board constituted an abuse of discretion because the evidence before it was insufficient to indicate that he had made use of any advertising claiming professional superiority. The appellate court, however, found no merit in this contention. It appears entirely clear, said the court, that an advertisement as "Oakland's leading plate dentist" constitutes an advertisement of professional superiority.

Barron next contended that the accusation filed with the board was insufficient to confer jurisdiction on the board in that "the accusation charges in the alternative and not positively and is indefinite, ambiguous, uncertain and unintelligible." This argument was directed at an allegation in the accusation that Barron did advertise "professional superiority or the performance of professional services in a superior manner." We find no merit in this argument, said the court. While so-called alternative pleading is ordinarily condemned, the accusation here was sufficient to confer jurisdiction on the board as no material allegations were alleged in the alternative. The accusation would have been sufficient in this regard if it had charged merely that the petitioner had been guilty of unprofessional conduct as defined in the Business and Professions Code in that Barron had advertised in a certain manner setting forth the advertisement in full.

Barron next contended that the accusation, on which the proceedings before the board were based, was not verified as required by the Business and Professions Code, since it was sworn to before the secretary of the Board of Dental Ex-

aminers, who, Barron claimed, was not authorized by law to administer oaths. The court, however, did not deem it necessary to discuss the question as to whether or not the secretary was authorized to administer oaths, since the defect complained of, if any, was waived by Barron by proceeding to a hearing before the board without objection.

Barron next argued that the accusation filed with the board charged a violation of the Business and Professions Code, "which code was not effective as law at the time of the commission of the alleged acts." He claimed that the last act of advertising he had done was the approval of the proof for the advertisement in the directory, which he had done on Aug. 23, 1937, and that the code in question did not become effective until Aug. 27, 1937. It may be pointed out, answered the court, that the advertising was done at Barron's direction in the November 1937 telephone directory, but, in any event, the provisions of the Business and Professions Code concerned were merely continuations of previously existing statutory provisions, and Barron was properly charged under the code with acts done prior to Aug. 27, 1937, in violation of the previously existing statutory provisions as continued in the new code.

Finally, Barron contended that the Board of Dental Examiners acted "arbitrarily, capriciously and oppressively" in suspending his license. Even assuming, he argued, that "the alleged offensive advertisement constitutes unprofessional conduct" and that the evidence shows that it was "run or printed in the November 1937 issue of the Oakland Telephone Directory," there is "no affirmative showing that the advertisement was ever brought home to the public and no witness called so testified." We are of the opinion, however, answered the Supreme Court, that the fact that the regular issues of the directory of the telephone company are "brought home to the public" is a matter of such common knowledge that there was no necessity for testimony with respect thereto.

For the reasons stated, the judgment of the lower court dismissing Barron's petition for a writ of mandate was affirmed.—Barron *v.* Board of Dental Examiners of State of California, 113 P. 2d, 247 (Calif., 1941).—*J.A.M.A.*, November 8, 1941.

BOARD OF DENTAL EXAMINERS—POWER TO RESTRICT ADVERTISING

THE Board of Regents of the State of New York had suspended the license of the petitioning dentist for a period of six months for unprofessional conduct. The specific act of unprofessional conduct charged was that the petitioner had violated Rule 5 of the rules promulgated by the Board of Regents, which prohibits "employing or making use of advertising solicitors or free publicity agents." The petitioner objected to this action and the case was brought before a special term of the Supreme Court.

The authority of the board to enact the rule prohibiting the use of advertising solicitors or free publicity press agents, said the court, stems from an amendment to the dental practice act which provides for disciplinary action upon proof that "the dentist has advertised for patronage by means of handbills, posters, circulars, stereopticon slides, motion pictures, radio or newspapers." Nothing in this amendment mentions the use of "advertising solicitors or free publicity press agents," continued the court, and therefore the rule forbidding their use goes beyond the prohibition contained in the statute and is invalid.—Rubenstein *et Al. v.* Board of Regents of University of State of New York, 30 N.Y.S. 2d 362 (N.Y. 1941).

STATE SOCIETY OFFICERS' CONFERENCE

Sunday, February 22

PALMER HOUSE

CHICAGO

PROGRAM

MORNING SESSION

(Room 17)

8:00 to 8:15 a.m. CHARLES F. GRAY, presiding.

8:15 to 10:00 a.m. Business Administration.
Leader: FRANCIS J. CONLEY, Los Angeles, Calif.

10:00 to 12:00 m. Mechanics of State Society Administration.
Leader: O. J. MERWIN, St. Paul, Minn.

LUNCHEON

12:00 m. to 2:00 p.m.

(Room14)

Speaker — OREN A. OLIVER, President of the American Dental Association

AFTERNOON SESSION

(Room 17)

2:00 to 4:00 p.m. How to Increase State Membership.
Leader: HENRY HICKS, Greenwich, Conn.

4:00 to 6:00 p.m. State Dental Society Finance Plan.
Leader: JOHN MCGHEE, Pittsburgh, Pa.

EVENING SESSION

(Sky Room)

8:00 Utilization of the Dental Profession in the National Emergency.
SAM F. SEELEY, Washington, D. C.
General discussion and résumé of day's program.

FIVE STATE POST GRADUATE CLINIC

WASHINGTON, D. C.

MARCH 8-12

PROGRAM

Dental Economics.....JAMES ROBINSON, Chicago, Ill.
Gold Foil.....PAUL W. ZILLMAN, Buffalo, N. Y.
Radiology.....R. S. VOORHEES, Rochester, N. Y.
Clinical Photography.....J. B. HUTCHERSON, Louisville, Ky.
Individual Unit Porcelain Bridge and Shoulderless Porcelain Jacket Crowns.....CARLISLE C. BASTIAN, New York, N. Y.
Hydrocolloidal Impression Technic.....MORRIS J. THOMPSON, Los Angeles, Calif.
Effects of Drugs on the Cells of the Blood....ROY R. KRACKE (M.D.), Atlanta, Ga.
Operative Dentistry.....ROGER E. STURDEVANT, Atlanta, Ga.
Amalgam Restorations.....M. M. MAXWELL, U. S. Navy Dental School
Exodontia and Minor Oral Surgery.....W. A. DANIELS, Springfield, Mass.
Fractures of the Maxilla and Mandible.....ROY C. STOUT, Walter Reed Hospital
Round table discussion: Complete Dentures and Partial Dentures.....

WALTER H. WRIGHT, Pittsburgh, Pa.
CLYDE H. SCHUYLER, New York, N. Y.
VICTOR H. SEARS, New York, N. Y.
MERRILL G. SWENSON, New York, N. Y.
E. HOWELL SMITH, Philadelphia, Pa.
L. G. JORDAN, Washington, D. C.

Entertainment: Stag night, with buffet supper; dinner dance; style show; state officers' luncheon; hygienists' luncheon; sightseeing trips; commercial exhibits.

The 1942 Five State Post Graduate Clinic *will be held as originally planned.* This is *official!* Ignore all rumors to the contrary! *Adequate hotel accommodations are available,* but reservations should be made *without delay!* No more reservations can be accepted at the Mayflower Hotel, but the following cooperating hotels have ample accommodations for all:

Ambassador	Harrington	New Colonial	Roosevelt
Annapolis	Lafayette	Plaza	Washington
Benedick	Lee Sheraton	Roger Smith	Willard
Blackstone			

Any difficulty in obtaining suitable hotel accommodations will be rectified by the Greater National Capital Committee, 204 Star Building, where you will receive every assistance.

All members of the American Dental Association are invited to attend the sessions of this meeting, at the Mayflower Hotel.

WILLIAM D. CURTIS, *Chairman*
Publicity Committee
1726 Eye St., N. W.
Washington, D. C.

MOBILE DENTAL CLINIC

PRESENTED TO ROYAL CANADIAN DENTAL CORPS BY ALPHA OMEGA FRATERNITY

ALPHA Omega Fraternity presented a mobile dental clinic to the Royal Canadian Dental Corps in an outdoor ceremony at the Memorial Tower, on the campus of the University of Toronto, January 10th.

Presentation was made by Dr. Bennett R. Sidenberg, Supreme Chancellor of the Fraternity, to Colonel F. M. Lott, Director of Dental Services for the Canadian Army, Navy and Air Force.

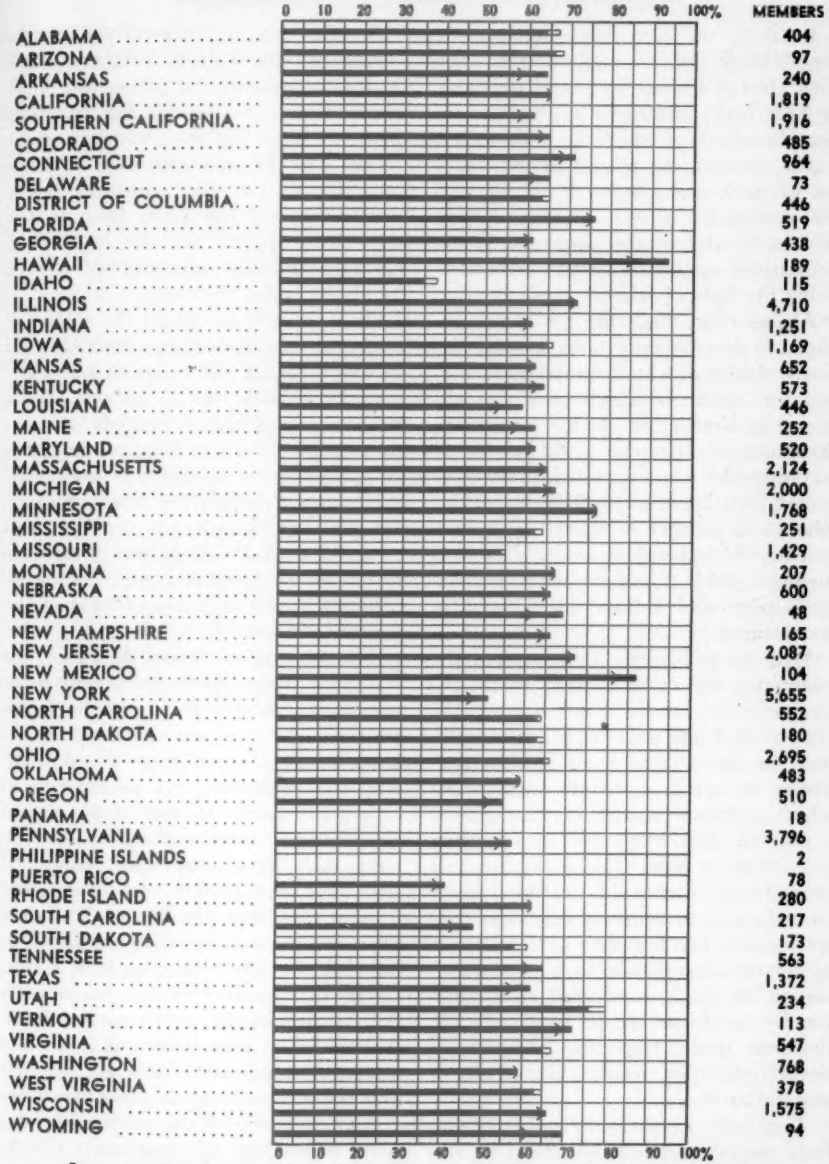
Among those present at the ceremonies were President H. J. Cody of the University of Toronto; Dr. A. D. A. Mason, Dean of the School of Dentistry; Dr. F. J. Conboy, Mayor of Toronto; Dr. Edward Pressman of Philadelphia, Chairman of the Ambulance Committee and Dr. William Rich, National Secretary of Alpha Omega.

The international character of the gift was stressed by all the speakers. Dr. Conboy, speaking both as Mayor of Toronto and as a member of the Dental profession said, "It symbolizes the goodwill of the dental profession of the United States and Canada, and is presented in a very tangible fashion."

At the national convention of Alpha Omega held in New York City from December 29th to December 31st, it was proposed to inaugurate a campaign to raise funds for a few mobile dental units for the Armed Forces of the United States. A vigorous drive is now on!

Membership Page

PERCENTAGE OF DUES RECEIVED IN CENTRAL OFFICE AS OF DECEMBER 31, 1941, AS COMPARED TO 1940 MEMBERSHIP



Percentage based on dental population figures supplied by the State Society Secretaries

1941 percentage. 1940 percentage.

ENDOWMENT FUND FOR THE JOURNAL OF DENTAL RESEARCH

IN 1909, the New York Institute of Stomatology (since merged with the First District Dental Society of the State of New York) appointed a committee on dental research of which the undersigned was a member. In pursuit of the duties for which it was appointed, the committee secured the services of a biochemist in Boston, who, at the suggestion of the committee, undertook certain researches along the lines of salivary analysis.

At one time, while the committee engaged in these investigations, inquiry was made of it as to why it should go to Boston for assistance which could be obtained in New York. At the same time, the name of one who could be highly recommended was suggested. The committee then interviewed William J. Gies, who for a number of years had been a teacher of biochemistry in the schools of medicine and pharmacy at Columbia University, and enlisted his interest in the research.

With an enthusiasm that inspired the committee and every member of the organization of which it was a part, Dr. Gies entered into their plans for research, and for thirty-three years he has continued to carry on in the same spirit which animated him in his first efforts.

Out of this long and praiseworthy association of more than thirty years of unremitting interest in dentistry, three contributions to dentistry stand out conspicuously: The founding of the *Journal of Dental Research,* in 1919; the organization of the International Association for Dental Research, in 1920, and the five-year study, beginning in 1921, of dental education in the United States and in Canada.

The part which these achievements have played in the advancement of dentistry throughout the world can hardly be measured.

Dentistry has had its great benefactors —men like the Forsyth Brothers, Eastman, Guggenheim and others who have given of their wealth for the establishment of clinics and the treatment of the needy. For this, the profession is grateful; but, in Dr. Gies, dentistry has a benefactor who has given liberally not only of his means, but also of himself, his time and his extraordinary talents, for almost half a lifetime.

On February 21, 1942, Dr. Gies will celebrate his seventieth birthday. It should be made the occasion for widespread recognition of his notable contributions to professional progress, and expression be given to the esteem in which he is held by the members of the dental profession. Probably the most appropriate and appreciable manner in which recognition of Dr. Gies' service to dentistry can be memorialized is in a contribution to the endowment fund of the *Journal of Dental Research.*

The *Journal of Dental Research,* for seventeen years edited and prepared for publication by Dr. Gies without remuneration, like most research journals has never been self-supporting. For this reason, the profession has undertaken to raise an endowment fund of $50,000 to insure its continued publication. Already more than $30,000 has been subscribed and most of it paid in. An opportunity is here presented for the profession to show its appreciation of what Dr. Gies has done for the advancement of dentistry by making his birthday the occasion for completing this much needed fund. A few dollars from each will insure the continued publication of a journal that will go on recording the scientific progress of dentistry for the guidance of this and succeeding generations. Checks should be made payable to the Endowment Fund of the Journal of Dental

Research and sent to the treasurer, Leuman M. Waugh, 576 Fifth Avenue, New York.

The obligation which the profession owes to Dr. Gies can never be repaid. Here is an opportunity to express in a tangible way our recognition of the debt and our appreciation of his many contributions to dentistry, not the least of which is the *Journal of Dental Research*.

ARTHUR H. MERRITT.

CORRESPONDENCE

"SOLUTION 58 (HANKE) NOT ACCEPTABLE FOR A.D.R."

To the Editor:

As a group, we wish to offer a protest against the very voluminous, but unconvincing report of the Council on Dental Therapeutics upon "Solution 58 (Hanke)," in the November issue of THE JOURNAL, based on the testimony of an anonymous "referee" and anonymous "consultants." We feel that the entire attitude of the Council in this matter savors of intense bias and that, in its effort to discredit our findings, the salient facts have been ignored or minimized. There are, in the report, several inaccuracies, inconsistencies and irrelevancies to which we wish to call attention.

First let us state that in presenting this formula, completely, to the dental profession, we felt and we feel that we have made a valuable contribution toward solving the problem of dental caries. That is concurred in by many very capable dentists outside our immediate group who have been most enthusiastic about their own results from its use. Finding it difficult to obtain the basic mercurial in a pure state in sufficiently large quantities to supply the demand, we were able to persuade a local pharmaceutic concern to provide us therewith and it necessarily followed that the preparation should be presented to the Council for approval. (In this connection, we may state that the preparations mentioned in the Council report as being labeled "not for drug use" were analyzed and found not acceptable to us because of impurities. On these, we agree with the Council.)

The Council, while agreeing that "the evidence presented goes far toward establishing the safety of the preparation," concludes farther on that "apparently, data on acute and chronic toxicity are not available; nor does there appear to be any evidence on the rate and extent of absorption from the oral mucosa." As a matter of fact, such data have been available and were presented in the Section on Operative Dentistry at the recent American Dental Association meeting. These data were readily available. One-third ounce of Solution 58 contains exactly one-fifty-fifth grain of mercury, as the referee could readily have determined from the published formula. Metaphen, which Bunting reports having used, contains an identical amount, yet it is an "accepted" dental remedy and the Council, in its 1940 edition of Accepted Dental Remedies, states that "as a general mouth rinse, a 1:5,000 solution may be used."

There is presented, in this report, a lengthy quotation from an old edition of Cushny (1928), but it stops short of the following: "The first symptoms generally arise from the mouth and throat, the patient complaining of a metallic taste and a feeling of numbness and soreness of the tongue and gums. The breath has an unpleasant fetid odor, the tongue is swollen and thickly coated, the gums are soft, swollen and often of a dark bluish-

red or gray color and the flow of saliva is augmented." In contrast, the report of the Council states that "it is not possible to place complete reliance upon oral symptoms for the detection of chronic mercury poisoning." Thus its own reference does not bear it out.

And since this report dwells at length upon certain other symptoms of mercury poisoning, may we call the attention of the Council to the text by Alice Hamilton, an authority upon industrial poisoning. In her book "Industrial Toxicology" (p. 72), she states, "The picture of mercurial poisoning, as we find it in text books on toxicology, is not quite what we usually see in industrial mercurialism. The severe gastro-intestinal symptoms, with nausea, vomiting, pain, purging, bloody stools, and the severe involvement of the kidneys, with scanty urine loaded with albumin and casts, form a picture almost never seen in industry." Again (p. 74), she repeats: "But usually in industrial mercurialism gastro-intestinal symptoms are not prominent, nor is there much, if any, involvement of the kidneys. . . . Apparently the kidneys can eliminate mercury for a long period without damage, and urinary changes may be absent in cases of undoubted mercurialism of a slow chronic form. . . . *Industrial mercurialism* (italics ours) *is characterized by three features: inflammation of the mouth, muscular tremors and psychic irritability —sometimes all three together, sometimes only two or only one. The changes in the mouth, inflammation of the gums, which are soft and spongy, loosening of the teeth, swelling of the salivary glands, and excessive flow of saliva are so well known as to give the name to the disease.*" (Salivation.)

It appears to us, therefore, that if, as both the Council and the other quoted authority state, the oral symptoms are almost invariably those first manifested, the dentists of this group and those collaborating are quite competent to observe any such manifestations, if they were to occur, in the mouths of the multitude of patients who have been using the Solution 58; *or in their own mouths,* all of them having used it consistently themselves. In our opinion, this disposes of the *bête noir* of "toxicity."

Incidentally to the comment that "the name of the product is in conflict with the provisions of Rule 8," may we respectfully draw the attention of the Council to the fact that a product—ammoniacal silver nitrate—is an "Accepted Dental Remedy," and that, similarly, it bears the name of Dr. Howe, a member of the Council.

We assert that we have demonstrated the basic truth of J. Leon Williams' findings of over forty years ago. We have been able, with the solution under discussion, to eliminate dental plaques and, by doing so, have arrested caries in many mouths previously subject to rampant caries. We have satisfied ourselves both by clinical observation and by animal experimentation that this solution, which was used after fifty-seven other agents had been tried and discarded, presents so little possibility of toxicity as to make this consideration negligible; and that case records going back as far as twenty years constitute a "control" that should be above question. If the American Dental Association is honestly concerned in solving the problem of dental caries, by all means let a larger group of dentists have the opportunity to add their experience to ours.

D. MAURICE WOODLOCK, *Secretary,*
Chicago Dental Research Club.

OBITUARY

B. FREDERICK PHILBROOK, D.D.S.

(1853-1941)

B. FREDERICK PHILBROOK was born in Camden, Maine, January 13, 1853, the third child of Luke and Lucinda (Smith) Philbrook. In 1857, his parents moved to Ohio, where they settled on a farm in Delaware County. Here, in 1859, Dr. Philbrook began his formal education in in the rural school at Jersey. In 1866, the death of his elder brother in the Union Army hastened the death of his mother, and the family moved to the town of Delaware, where Dr. Philbrook graduated from the high school, in 1870. Having secured a teacher's certificate, he spent two years teaching in the rural schools of Delaware County. Feeling the urge to "go west," he lived for a year with relatives on a farm near Champaign, Ill., working as a laborer in the construction of the Illinois Central Railroad. He returned to Ohio in 1873 and obtained employment as a collector for a sewing machine company, making his headquarters in Mt. Vernon, where he met Thomas E. Weeks, who was practicing dentistry in that city. It was this acquaintance that determined what Dr. Philbrook's career was to be.

When Dr. Weeks moved to Council Bluffs, Iowa, and established himself there, Dr. Philbrook followed him, in 1875, and entered his office as an apprentice and student. During the years of his study, he supported himself by the repair of sewing machines in Council Bluffs and Omaha. In 1879, his tutor pronounced him ready for the practice of his chosen profession, and, having made with his own hands his slender equipment of instruments, he moved to Dunlap, Iowa, and began the practice of dentistry, April 14, 1879.

During his years in Dunlap, Dr. Philbrook helped organize the Omaha Dental College and for several years was a member of its faculty. He married Ida Mary McAlister in Chicago, April 23, 1887. Continuing his practice in Dunlap, and particularly interested in the mechanical aspect of his profession, he began, in 1893, his experiments in the casting of fillings. In 1896, he moved to Denison, Iowa, where he established his practice and continued his experiments. In 1897, he prepared and read, before the Iowa State Dental Society, his now famous paper on the casting of fillings, having previously introduced the subject to the county society. In 1915, he was the principal witness for the Dentists' Mutual Protective Association in the defeat of the Taggart patents, the decision of the court in the matter being based upon his office records of cast fillings and a copy of his paper discovered in the dental library of the State University of Iowa.

In October 1916, he moved to Sioux City, Iowa, where he established a practice limited to orthodontia. His wife died in that city, August 27, 1927. Dr. Philbrook continued his practice until December 1, 1937, when he retired, after a continuous practice in the State of Iowa of almost fifty-nine years. He moved to Davenport, Iowa, to make his home with his son, where he died after a long illness, November 16, 1941. Burial was in Sioux City. Surviving are his son, Rowland Frederick Philbrook, D.D., dean of Trinity Cathedral, Davenport, Iowa; two grandsons, James F. and Robert R. Philbrook, and a brother, J. Frank Philbrook, Council Bluffs, Iowa.

DEATHS

ANDERSON, ERNEST J., Minneapolis, Minn.; University of Louisville, School of Dentistry, 1902; died recently.

BAUCHERT, MAHLON F., El Paso, Texas; Colorado College of Dental Surgery, 1898; died October 16; aged 69.

BEAMON, REGINALD E., Cincinnati, Ohio; Howard University College of Dentistry, 1916; died August 16; aged 51.

BROWN, HOMER T., Archbold, Ohio; Ohio College of Dental Surgery, 1903; died September 25.

CONKLE, FRANKLIN B., Toledo, Ohio; Ohio College of Dental Surgery, 1904; died November 12; aged 66.

COPELAND, IRVING W., Ashland, Ohio; University of Michigan School of Dentistry, 1896; died November 3; aged 67.

DULANEY, B. F., Colorado, Texas; Baltimore College of Dental Surgery, 1891; died November 9; aged 71.

FORRESTER, CLIFFORD C., Detroit, Mich.; University of Michigan School of Dentistry, 1913; died October 21; aged 52.

FRENCH, J. S., Rice Lake, Wis.; Northwestern University Dental School, 1899; died August 10; aged 65.

FUNDENBERG, C. R., Pittsburgh, Pa.; Temple University School of Dentistry, 1899; died December 26.

GAMBATTI, O. F., Houston, Texas; Vanderbilt University School of Dentistry, 1884; died December 13.

GAMMANS, WILLIAM E., Alameda, Calif.; Baltimore College of Dental Surgery, 1900; died November 10.

GILE, HOLLAND, Hanover, N. H.; Tufts Dental College, 1913; died September 30; aged 50.

GOTSCHE, ELMER F., Racine, Wis.; Marquette University School of Dentistry, 1917; died recently; aged 49.

GREGG, WILLIAM A., Felicity, Ohio; Ohio College of Dental Surgery, 1894; died September 3; aged 73.

HALL, FOREST, Osseo, Wis.; Marquette University Dental School, 1920; died August 30; aged 42.

HARNED, JAMES E., St. Petersburg, Fla., formerly of Rockford, Ill.; Chicago College of Dental Surgery, 1892; died October 9; aged 70.

HEYL, ASA W., Evans City, Pa.; University of Pittsburgh School of Dentistry, 1903; died November 20.

HOWELL, O. C., Commerce, Texas; died October 21; aged 89.

HUNT, J. P., Mount Pleasant, Iowa; State University of Iowa College of Dentistry, 1885; died October 28; aged 78.

LEAZENBY, RAYMOND E., Mount Ayr, Iowa; State University of Iowa Dental College, 1926; died October 9; aged 37.

LORIMER, BRUCE M., Milwaukee, Wis.; Marquette University School of Dentistry, 1922; died October 17; aged 44.

PETERS, LEONARD A., Boone, Iowa; Northwestern University Dental School, 1921; died September 21; aged 42.

PHILLIPS, P. KENDRICK, Cincinnati, Ohio; Ohio College of Dental Surgery, 1904; died October 21.

SIBLEY, NICHOLAS B., Akron, Ohio; died July 31; aged 83.

SWAN, EARL G., Akron, Ohio; Ohio State University College of Dentistry, 1908; died August 15.

THOMAS, GEORGE E., Columbus, Ohio, Ohio Medical University College of Dentistry, 1902; died November 16; aged 61.

THOMPSON, JAMES X., Reedsburg, Wis.; Northwestern University Dental School, 1897; died August 22; aged 78.

TROSPER, JAMES W., Seattle, Wash.; Colorado College of Dental Surgery, 1908; died December 12; aged 66.

WARD, THADDEUS S., Marietta, Ohio; Ohio College of Dental Surgery, 1894; died December 19; aged 74.

WILSON, EVERETT L., Port Washington, N. Y.; University of Pennsylvania School of Dentistry, 1915; died December 1.

REQUEST FOR AID IN IDENTIFICATION

FOLLOWING is a description of the dental work of an unidentified man, white, 5 feet 11 inches tall, weight from 165 to 180 pounds, dark blond hair, age early thirties, whose body was found November 25, 1941, near Oklahoma City, with a 38-caliber bullet wound in the right temple. The body was nude and no identification could be made other than from the dental work, of which pictures and descriptions are enclosed. Any dentist having a record of this dental work is asked to notify George Goff, sheriff of Oklahoma County, Oklahoma City.

W. B. Kessler, dentist, has furnished the following description of the teeth of the deceased:

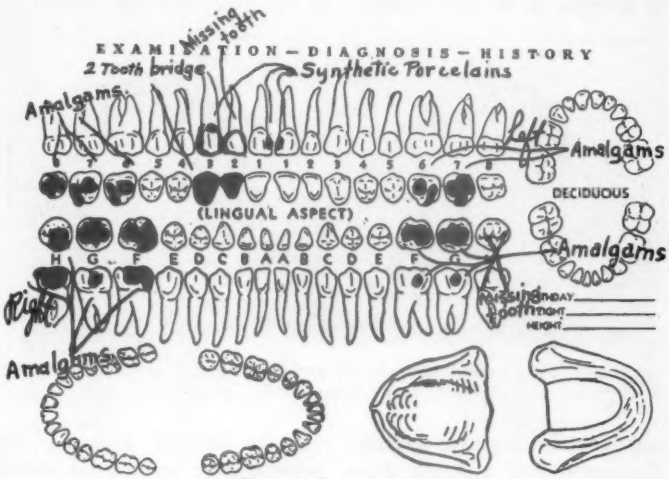


Fig. 1.—Dental chart.

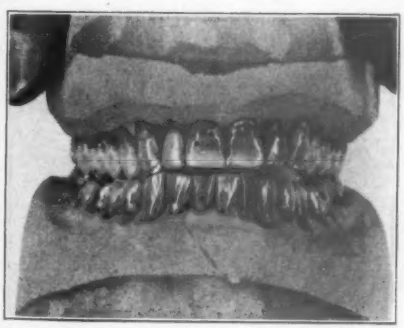


Fig. 2.—Front view of reconstructed denture.

Fig. 3.—Side view of reconstructed denture.

The amalgam fillings were excellently constructed and deeply grooved, and carried out the normal anatomic structure of the well-defined cusps and fissures of teeth. The synthetic porcelain fillings

were well constructed, but a little washing of the margins had occurred. The two-tooth bridge supplying the missing upper right lateral incisor is a fine piece of dental work. It is a Tinker type three-quarter crown. The good condition of the dental work indicates that it was done by an outstanding dentist. It is also evident with an overjet of the upper incisors a little beyond normal and slight protrusion of the upper central incisors. Cusps of the molars and bicuspids are high and well formed. Slight calcareous deposits on the lingual surface of the lower incisors were noted at the time of removal of the teeth from the body.

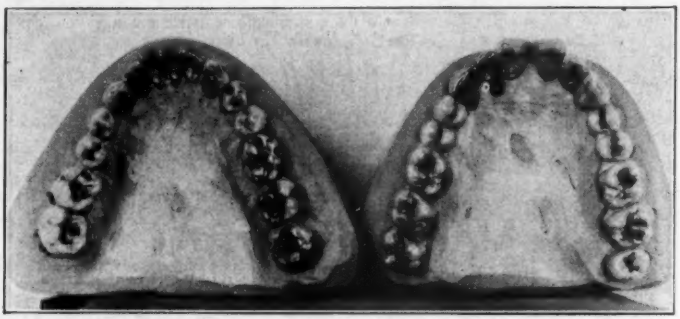


Fig. 4.—Occlusal view of arches, showing the general excellency of the dental work, and the exceptionally well made canine-lateral incisor bridge in the upper jaw.

that most of the work was done recently and that the patient had a regular dental check-up. The teeth are medium long and tapering, indicating a long, tapering face. The amount of wear on the facets of the occlusal cusps would indicate that the man was about 35 or 40 years of age. The occlusion is normal,

It is believed that the body was brought here from a far distant point.

Any aid in identifying it will be greatly appreciated.

GEORGE GOFF, *Sheriff*,
Oklahoma County,
Oklahoma City, Okla.

INCIDENTS OF PRACTICE

Method of Bringing into Position an Overretained Impacted Upper Right Central Incisor

By Samuel R. Siegel, D.M.D., Poughkeepsie, N. Y.

REPORT OF CASE

History.—A boy, aged 13, in November 1937 consulted the family dentist, complaining of a loose deciduous upper right central incisor. An x-ray picture of the area revealed an impacted permanent upper right central incisor. (Fig. 1.) To relieve the pain, the deciduous tooth was extracted. After consultation with an orthodontist, it was decided to wait to see whether the tooth would erupt of its own accord.

Fig. 1.—Impacted permanent right central incisor.

Fig. 2.—Position of impacted incisor four years later.

Unfortunately, the patient did not return for four years, at which time he was referred to me for treatment.

Examination.—The picture at this time had changed somewhat. The impacted tooth was in the same position (Fig. 2), but the problem was complicated by a mesial drift of the entire segment, from first molar to lateral incisor, due to the break in the continuity of the arch.

Fig. 3.—Space created for impacted tooth.

Fig. 4.—Postoperative procedures.

Treatment.—The first stage of treatment consisted in creating enough space to bring the impacted tooth into position. The upper right first molar was moved distally by means of an intermaxillary elastic. The elastic traction went from a hook on the lower right first molar to a hook on the upper labial arch in the cuspid region. Then the two bicuspids were moved distally, be-

ing tied to the first molar. Meanwhile, the intermaxillary traction was continued. The cuspid was then moved distally by means of an intermaxillary elastic anchored to the impacted tooth. The lateral incisor was moved distally, being tied to the cuspid.

After a space had been created for the impacted tooth (Fig. 3), it was decided to expose as much of the crown of that tooth as possible.

Operation.—Under local anesthesia, a surgical operation was performed in which the overlying bone was removed from around the impacted tooth. While anesthesia still existed, a copper band impression of the tooth was taken. A dressing was now inserted to prevent the tissues from growing together while the new appliance was being constructed.

Postoperative Procedures.—A cast gold crown was made. A gold post (0.025) with an eyelet at the end was soldered to the casting, and the casting cemented on the impacted tooth. (Fig. 4.)

A finger spring (0.022) with an eyelet at the free end was soldered to a heavy labial arch (0.036). The heavy arch was inserted in the terminals at the first molars.

By tying the finger spring to the eyelet on the post, a downward adjustment was given to the impacted tooth. This action was repeated until the tooth was brought about half way down. Owing to interference from the lower teeth, the casting was removed and a band made. The band had an eyelet soldered on the labial surface for tying to the finger spring. (Fig. 5.) Adjustments were continued in the same manner until the tooth had been brought down into good position. (Fig. 6.)

Fig. 5.—Condition after removal of casting and placing of band.

Fig. 6.—Tooth in position.

Fig. 7.—Case before and after treatment.

Outcome.—After the impacted tooth had been brought into position, the following results were noted:

The impacted tooth responded to a vitality test as readily as the other central incisor.

An x-ray picture of the tooth showed no root resorption.

A good esthetic result was obtained.

Figure 7 shows the case before and after treatment.

Salvaging Silver Alloy and Mercury

By BEN DENT, D.D.S., Memphis, Tenn.

"BREAD and butter" dentistry is largely dependent on silver alloy and mercury. For some time, mercury has been difficult to obtain. With a state of war existing, it will be increasingly difficult to secure mercury and silver alloy.

Conservation will help the program of defense and protect the dental profession from a shortage of vital materials.

We must begin *now* to prepare for the future. It can be done!

1. Save scrap silver amalgam and mercury. By refining, the mercury and other metals can be recovered. The excess mercury, while the silver amalgam is being used at the chair, can be expressed into a wide-mouthed bottle. Later, the contents of this bottle can be run through a chamois cloth. The solid residue can be placed with the scrap while the cleaned liquid metal is set aside to accumulate. When a sufficient amount has been collected, it can be sent to a refinery.

A conservative estimate would show a saving of 50,000 pounds of mercury and 50,000 pounds of silver alloy each year within the American Dental Association.

2. Save the lead backings in x-ray film packets. It can either be given to the Red Cross or be sold.

2617 Broad Street.

Heredity and Anodontia

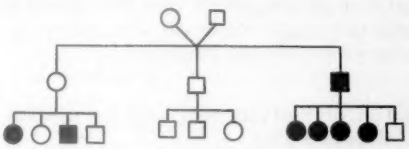
By FRED CARMOSIN, D.D.S., Philadelphia, Pa.

History.—A woman, aged 24, complained of vague pains in the head which she could not definitely localize. She also complained of gradually diminishing vision in both eyes, with accompanying pain in the area of the eyes. This had gone on for the past five years without any relief, in spite of consultation with ophthalmologists. Eye specialists seemed to believe that eventually the sight of both eyes would be lost. Recently, the patient had become greatly alarmed because of the appearance of a red eruption.

Examination.—The patient was wearing a full upper denture with about half a complement of teeth in the lower jaw. Roentgenographic studies revealed two impacted cuspids each directly under the canine eminence on each side. A left upper third molar was unerupted in that particular tuberosity area. At the lower left retromolar triangle was an unerupted third molar. Also, in the left lower anterior area, there was an impacted cuspid.

Operation.—The infected upper cuspids were extracted at one sitting. At the three subsequent visits, the three remaining impacted teeth were removed. At the last visit, the remaining teeth were extracted.

Results.—After removal of the upper cuspids, the patient stated that she could see more clearly. When the remainder of the teeth were out, the rash disappeared, and with it all aches and pains.



Comment.—Three sisters of the patient had either an entire denture impacted or many permanent teeth missing. The accompanying chart shows the cases of anodontia and impactions in this family. The father of the patient died of tracheitis, cause unknown. It is within the realm of possibility that the presence of thirty-two impacted teeth had a direct bearing on his death.

1201 North Fifth Street.

Sensitive Gingival Cavities

By A. E. BELANGER, D.D.S., Lovelock, Nev.

LATELY, I have discovered something of great value to me in preparing sensitive gingival cavities.

The usual sharp bur and a steady hand are essential. While the bur is in function, the patient is instructed to put considerable pressure with the thumb or finger on the opposite side of the tooth from the cavity. This anesthesia or analgesia is the most practical that I have ever heard of for this kind of work. I would not attempt to describe the theory of the anesthesia, but it has proved very useful to me.

CURRENT LITERATURE

Continuous Administration of Ethyl Chloride

By U. M. Westell

Administration of ethyl chloride by continuous vaporization is very effective in operations lasting from ten to seventy minutes. The ethyl chloride is sprayed into a chloroform bottle of the Boyle or Walton type, the quantity varying from 5 to 20 cc., depending on the duration of the operation and the resistance of the patient. Induction is with nitrous oxide, to which the ethyl chloride vapor is added slowly until adequate relaxation is obtained. The ethyl chloride is then cut down to the minimum required for maintenance. There is a rapid recovery, with little or no after-effects, and the patient is able to return home shortly after the operation.—*Lancet*, 2:666, November 29, 1941.

V. H. Powell.

Effect of Sulfanilamide and Its Derivatives on Fungi

By George M. Lewis and Mary E. Hopper

Sulfanilamide and five derivatives: sodium sulfapyridine, sulfathiazole, sodium sulfathiazole, sulfadiazine and sodium sulfadiazine) were tested as fungistatic agents against two species of fungi, *Trichophyton gypseum and Monilia albicans*. No inhibiting effect on the growth of *M. albicans* was observed. There was some fungistasis of *T. gypseum* with all of the compounds and complete retardation of growth for three weeks with sulfanilamide. The results showed the sodium salt to be a more effective fungistatic agent than the parent compound; which may be due to its greater solubility.—*Arch. Dermat. & Syph.*, 44:1101, December 1941.

Peter P. Dale.

Focal Infection

By C. H. Slocumb, M. W. Binger, A. R. Barnes and H. L. Williams

An evaluation of the importance of focal infection from the clinical standpoint alone as it concerns the three clinical entities of heart disease, chronic infectious arthritis and glomerulonephritis reveals that we progress from tepidity to relative enthusiasm to wholehearted acceptance of the conception of focal infection. From the clinical standpoint, it is found impossible to distinguish clearly among the acute focus, the subacute focus and the chronic focus, because the transitions between these several states are not sufficiently abrupt. It seems certain that the concept of focal infection is of definite clinical usefulness and that it is unreasonable to expect removal of foci of infection to eliminate the end-results of tissue necrosis. In a revaluation of the concept of focal infection, it would seem the more logical procedure to consider it in relation to a single disease entity rather than to become lost in generalities, and it would seem wise to consider, along with the results secured, the stage of the condition and the pathologic process involved.—*J.A.M.A.*, 117:2161, December 20, 1941.

V. H. Powell.

Some Effects of Sulfanilamide on Man at Rest and During Exercise

By F. J. W. Roughton et Al.

Six normal subjects were given from 2 to 3 gm. of sulfanilamide daily. The basal gas exchange, pulse, blood pressure, electrocardiogram and carbon dioxide and O_2 in the arterial blood were checked in each case before and during the administration. These observations were made during stages of rest, moderate exercise (from 5 to 6 times basal level) and exhaustive exercise. Psychologic tests were made on three subjects before, during and after sulfanilamide. Important conclusions are: 1. At rest and in moderate exercise, there is no change in the rate of carbon dioxide elimination by administration of sulfanilamide to a blood concentration of from 3 to 4 mg. per hundred cubic centimeters. 2. In exhausting exercise, carbon dioxide is dammed back, with resultant prolonged dyspnea during recovery. 3. Psychologic and physical handicaps

in subjects taking from 2 to 3 gm. of the drug daily unfitted them for exacting or strenuous work, especially where skill was needed.—*Am. J. Physiol.*, 135:77, December 1, 1941.

H. B. McCAULEY.

Effects of Congenital Syphilis on the Teeth and Associated Structures in Children

By W. B. JOHNSTON, B. G. ANDERSON and P. F. MCALENNEY

THIRTY-NINE known congenitally syphilitic children were studied clinically and roentgenographically. The teeth of the children were collected over a two-year period and examined grossly and histologically. When stigmas were observed, the anterior teeth and the first molars were involved as a group. The most consistent characteristic of syphilitic dental deformities was lack of development of the individual teeth and of the premaxillary bone. The "Hutchinson tread" was not observed. Histologically, the extracted teeth showed no changes from the normal attributable to congenital syphilis. No conclusion was reached concerning the relation of the disease to caries susceptibility. The literature on the subject is reviewed.—*Am. J. Orthodontics*, 27:667, December 1941.

H. B. McCAULEY.

Oral Manifestations of Vitamin Deficiencies

By L. A. ROSENBLUM and NORMAN JOLLIFFE

OWING to the lack of simple and rapid laboratory tests, vitamin deficiencies are best recognized by their oral manifestations. Lesions of the lips, gums, tongue and mucous membranes are characteristic of scurvy and of deficiency of several members of vitamin B complex. Scurvy lesions are rarely isolated, owing to accompanying deficiencies of other vitamins. Response to specific therapy is rapid.

Vascular diathesis is characteristic of vitamin C deficiency. Nicotinic acid lack produces early swelling and redness of the top and lateral margins of the tongue. Experimental riboflavin deficiency caused oral pallor and fissuring of the angles of the mouth. However, the polymorphous nature of oral lesions in nicotinic acid and riboflavin deficiency is demonstrated by the fact that only administration of the whole vitamin B complex will eradicate the lesions in many instances.—*J.A.M.A.*, 117:2245, December 27, 1941.

H. B. McCAULEY.

Electrolyte Changes in Submaxillary Glands During Stimulation

By J. H. WILLS

THE potassium content of the submaxillary gland remained fairly constant during electrical stimulation, but when it was stimulated by pilocarpine, a loss of that element was observed. Further experimentation, using dogs and cats, seemed to indicate that the gland, while losing potassium, picked up water and sodium after injection of pilocarpine. When it was stimulated by chorda excitation, water and sodium were gained without loss of much of any other element. Pilocarpine saliva was characterized by a high sodium and chlorine content. In cats, it also had a much higher lactic acid level than chorda saliva. The submaxillary gland concentrates the plasma during secretion. No explanation was offered for the loss of potassium after injection of pilocarpine.—*Am. J. Physiol.*, 135:164, December 1, 1941.

H. B. McCAULEY.

Halitosis

By B. B. CROHN and RUDOLPH DROSD

DISORDERS of the teeth, gums and pharynx account for *fetor ex ore*, but not for the internal malady which causes halitosis. The breath is an excretory channel of many absorbable odorous materials. This fact was demonstrated by experiments with a large number of hospital patients having a jejunostomy, ileostomy or colostomy opening; short-circuiting anastomosis, fistula or a pyloric stenosis. Raw chopped garlic was enclosed in double gelatin capsules and given orally or through other natural or artificial body openings. After from 0.5 to 1 gm. of garlic was administered, a latent period of from one-half to two hours ensued during which no odor on the breath could be detected. Thereafter, a strong odor appeared, which tapered off to musty faintness in between four and twenty-six hours. During that time, clearing the stomach and intestines by a saline solution of a cathartic

was ineffectual. Peppermint and wintergreen acted in the same way as garlic. True halitosis was found amenable to a low-fat diet. —*J.A.M.A.*, 117:2242, December 27, 1941.

H. B. McCAULEY.

Strength and Size of Bone in Relation to Calcium Intake

By G. H. BELL, D. P. CUTHBERTSON and J. ORR

DIETS varying only in calcium content, from 0.075 to 1.39 per cent, were fed to seventy-seven male albino rats. The femurs were tested for bending and twisting strength in special apparatus. The breaking stress, calculated from the results of the two tests, was taken as a measure of the bone quality. Increased calcium intake was accompanied by little variation in blood weight; a progressive rise in calcium retention, mirrored in the weight and content of the femora, in their strength and in the thickness of the femoral shell, but no change in the external dimensions of the femora, the percentage of calcium or the quality as disclosed by the breaking stress. Calcium intake above a certain maximum had no effect. Bone is elastic up to the point of breaking and is nearly as strong as cast iron.—*J. Physiol.*, 100:298, November 1941.

H. B. McCAULEY.

Cancer of the Gums (Gingivae)

By HAYES E. MARTIN

THIS is a detailed study of an unselected and consecutive group of 113 cases of cancer of the gingivae. The most common symptom first noted by the patient was the lesion itself, with local "soreness." A biopsy should be made in all cases on tissue from any suspicious ulcerated lesion in the mouth at the time of the first examination; for that is the method of diagnosing such lesions. It was found that epidermoid carcinoma made up almost 90 per cent of these cases. The average age of the patients was 61 years, and almost 70 per cent of cases occurred after the age of 60 years. In this series, 82 per cent were found in males and 18 per cent in females.

These cases of cancer of the gingivae were carefully analyzed in detail from the standpoint of etiology, clinical course, treatment and end-results. The patients were treated by radiation, surgery and a combination of the two methods. The net cure rate, calculated in 105 determinate cases, was 25.7 per cent.—*Am. J. Surg.*, 54:765-806, December 1941.

JAMES T. GINN.

Penetration of Phenol in Tooth Structure

By BERNERD O. A. THOMAS

BY the use of the bromine water test and eosin Y as a tracing agent, it was shown that phenol penetrates tooth structure. Phenol is not self-limiting as a result of its action on organic matter, and histologic sections showed that there are inflammatory reactions in the dental pulp under phenolyzed cavities, even though there were no subjective symptoms. Metamorphosed dentin was not penetrated by phenol. *In vitro* experiments showed the penetration from the pulp canal through the dentin and cementum to the surface. It was found that the penetration and effects of phenol depend on several conditions, including depth of cavity, amount of phenol used, degree of protective metamorphosis of the dentin, amount of secondary dentin present and condition of the dental pulp.—*J. D. Res.*, 20:435-444, October 1941.

JAMES T. GINN.

Rate of Increase of Dental Caries in Officers and Men Aboard an American Man of War

By CARL AUGUST SCHLACK

IN this study, made on a group of 707 officers and men aboard an American ship, the patients were divided into a subgroup of 498 who were examined by clinical means only and a subgroup of 209 who were examined clinically and roentgenologically. These patients ranged in age from 17 to 51 years. An initial examination was made of the teeth for dental caries and a reexamination of the same patients was made one year later. Evaluation of tooth destruction was made by surface and included restorations as well as carious areas.

It was found that in all age groups, except ages 30 to 34, a greater number of tooth surfaces were found attacked by caries where a combination of clinical and roentgenographic means were used in the examination.

The results, after a period of one year, showed less apparent caries increase (0.29 surfaces per patient) in that group examined by a combination of roentgenographic and clinical means than in that group examined clinically only (0.85 surfaces per patient). It was suggested that present rate increase of dental caries must be re-checked, because more accurate initial examination tends to diminution of the apparent rate of caries increase.—*J. D. Res.*, 20:477-481, October 1941.

JAMES T. GINN.

Vital Staining of Growing Bones and Teeth with Alizarin Red S

By ISAAC SCHOUR et Al.

IN experimental studies on the use of alizarin red S including chemistry, mode of action, preparation of solution, dosage, method of administration, toxicology and effect on calcifying tissues, the authors found that an intraperitoneal injection of a saturated solution (2 per cent) of the dye at a dosage of 50-100 mg. per kilogram produces a sharp red line in the bone and dentin calcifying at the time, and that effective doses can be given without significant toxic complications. It is suggested that a preparation of alizarin red S which contained radioactive or radiopaque substances was of increased effectiveness in experimental studies, and that this dye offers a possible method of assaying growth-inhibiting and growth-promoting substances.—*J. D. Res.*, 20:411-418, October 1941.

JAMES T. GINN.

Prevention of Dental Caries by Massive Doses of Vitamin D

By R. H. BRODSKY, B. SCHICK and H. VOLLMER

A GROUP of 200 children between the ages of 2 to 16 years (on 101 of whom data are reported) who had tuberculosis or had been in contact with a patient having the disease were studied carefully for a period of approximately one year in the Sea View Hospital to determine the effect of a single massive dose of vitamin D on the incidence of dental caries. These children were divided into three groups: a control group (A), who received only the hospital diet devoid of cod liver oil or any other additional source of vitamin D; a second group (B), who received, in addition to the hospital diet, 305,000 U.S.P. units of vitamin D and 2,455,000 U.S.P. units of vitamin A in 30 cc. of fish liver oil concentrate, and a third group (C), who received 600,000 U.S.P. units of vitamin D in the form of crystalline vitamin D_3 in 1 cc. of oil in addition to the same hospital diet.

None of the children showed any toxic effects after the single massive dose of vitamin D. In the control group (A), there developed thirty-nine cavities, or 1.18 new cavities per child during the observation period. In group B, thirteen cavities (0.39 cavity per child) developed, and in group C, six cavities (0.17 cavity per child) developed. The results seem to indicate that the incidence of dental caries may be markedly decreased by the administration of a single massive dose of vitamin D.—*Am. J. Dis. Child.*, 62:1183, December 1941.

J. EDWARD GILDA.

General Anesthesia in Treatment of Maxillofacial Cases

By T. E. FISCHER

THE author believes that with a competent anesthetist administering the anesthetic agent, and with hospital and laboratory facilities and the wide selection of agents and methods of producing general anesthesia, there are few contraindications for general anesthesia. Anesthetic agents, listed in the order of decreasing safety, are nitrous oxide, ethylene, cyclopropane, ethyl chloride, vinyl ether (vinethene), ethyl ether and chloroform. Emphasis is placed upon the need for careful selection of the anesthetic agent in each case encountered.—*Mil. Surgeon*, 89: 877, December 1941.

J. EDWARD GILDA.

Ludwig's Angina

By LILIAN LINDSAY

To forestall the fate that has befallen a great number of men whose names have identified diseases or anatomic structures, the author gives a brief account of Ludwig's life. Probably for the first time, the original German article in which Ludwig describes his angina is translated into English. The original appeared without a heading in *Medicinisches Correspondenz-Blatt* in 1836. —*D. Rec.*, 61:351, December 1941.

H. B. MCCAULEY.

ANNOUNCEMENTS

Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of The Journal.

CALENDAR OF MEETINGS

American Academy for Plastics Research in Dentistry, Chicago, Ill., February 22.

American Association of Orthodontists, New Orleans, La., March 16-19.

American Association of Public Health Dentists (Executive Council), Chicago, February 24.

American Dental Assistants Association, Boston, Mass, August 24-28.

American Dental Association, Boston, Mass., August 24-28.

Chicago Dental Society Midwinter Meeting, February 23-26.

Cleveland (Ohio) Dental Society, May 4-6.

District of Columbia Dental Society, second and fourth Tuesdays in each month, from October to June at the United States Public Health Service Auditorium, Washington.

Five State Post Graduate Clinic, Washington, D. C., March 8-12.

Greater Philadelphia Annual Meeting, February 3-6.

National Board of Dental Examiners, May 4-5.

New York Society of Orthodontists, February 23-24.

Ontario Dental Association, Toronto, May 18-21.

Greater Philadelphia Annual Meeting, February 3-6.

Southwestern Society of Orthodontists, New Orleans, La., March 16-19.

Thomas P. Hinman Midwinter Clinic, Atlanta, Ga., March 23-24.

STATE SOCIETIES

March

Minnesota, at St. Paul (3-5)

Kentucky, at Louisville (March 30-April 3)

April

Alabama, at Birmingham (7-9)

STATE BOARDS OF DENTAL EXAMINERS

Kentucky, at Louisville, June 9-12. Leon M. Childers, 1312 First Nat'l Bank Bldg., Lexington, Secretary.

New Jersey, June 29-July 4. W. A. Wilson, 150 East State St., Trenton, Secretary.

AMERICAN ACADEMY FOR PLASTICS RESEARCH IN DENTISTRY

The American Academy for Plastics Research in Dentistry will meet at the Palmer House, Chicago, Ill., February 22, at 2 p.m. Address requests for admission to

LaMar W. Harris, *Secretary,*
25 E. Washington St.,
Chicago, Ill.

AMERICAN ASSOCIATION OF ORTHODONTISTS

The 1942 meeting of the American Association of Orthodontists will be held at the Roosevelt Hotel, New Orleans, La., March 16-19. This will be a pan American congress. A special invitation is extended to orthodontists in Central and South America.

Max E. Ernst, *Secretary,*
1250 Lowry Medical Arts Bldg.,
St. Paul, Minn.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS

The midwinter meeting of the Executive Council of the American Association of Public Health Dentists will be held in Room 741, Palmer House, Chicago, beginning at 8:30 a.m., February 24.

Frank C. Cady, *Secretary,*
U. S. Public Health Service,
Lexington, Ky.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The eighteenth annual session of the American Dental Assistants Association will be held in Boston, Mass., August 24-28. For further information, address

Aileen M. Ferguson,
General Secretary,
709 Centre St.,
Jamaica Plain, Mass.

CHICAGO DENTAL SOCIETY MIDWINTER MEETING

THE 1942 Midwinter Meeting of the Chicago Dental Society will be held at the Palmer House, February 23-26.

GLENN E. CARTWRIGHT, *President.*

CLEVELAND DENTAL SOCIETY

THE Annual Spring Clinic Meeting of the Cleveland (Ohio) Dental Society will be held May 4-6 at the Statler Hotel, Cleveland.

ALBIUN F. SADD, *Chairman,*
Publicity Committee,
562 Rose Bldg.,
Cleveland, Ohio.

FIVE STATE POST GRADUATE CLINIC

THE annual Five State Post Graduate Clinic of the District of Columbia Dental Society will be held at the Mayflower Hotel, Washington, D. C., March 8-12.

WILLIAM D. CURTIS, *Chairman,*
Publicity Committee.

NATIONAL BOARD OF DENTAL EXAMINERS

THE National Board of Dental Examiners will hold its next session for the examination of candidates in Parts I and II, May 4-5, in schools where there are five or more candidates. For further information and application blanks, address

MORTON J. LOEB, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

NEW YORK SOCIETY OF ORTHODONTISTS

THE annual meeting of the New York Society of Orthodontists will be held at the Waldorf-Astoria, New York, February 23-24.

WILLIAM C. KELLER, *Secretary,*
40 E. 49th St.,
New York.

ONTARIO DENTAL ASSOCIATION

THE seventy-fifth annual convention of the Ontario Dental Association will be held at the Royal York Hotel, Toronto, May 18-21. Dentists from the United States and all parts of Canada will be welcome.

EDMUND A. GRANT, *President.*

GREATER PHILADELPHIA ANNUAL MEETING

THE Greater Philadelphia Annual Meeting, which will be a combined meeting of the Pennsylvania State Dental Society and the Philadelphia County Dental Society, will be held February 3-6 at the Benjamin Franklin Hotel.

ABRAM COHEN, *Chairman,*
Publicity Committee,
269 S. 19th St.,
Philadelphia, Pa.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

THE February meeting of the Southwestern Society of Orthodontists has been postponed. A regular business session will be held during the meeting of the American Association of Orthodontists, New Orleans, March 16-19.

R. E. OLSON, *Secretary,*
Union Nat'l Bank Bldg.,
Wichita, Kan.

THOMAS P. HINMAN MIDWINTER CLINIC

THE Thomas P. Hinman Midwinter Clinic will be held at the Biltmore Hotel, Atlanta, Ga., March 23-24.

JOSEPH D. OSBORNE, *Secretary,*
604 Doctors Bldg.,
Atlanta, Ga.

ALABAMA DENTAL ASSOCIATION

THE seventy-third annual session of the Alabama Dental Association will be held at the Tutwiler Hotel, Birmingham, April 7-9.

GEORGE W. MATTHEWS, *Secretary,*
Protective Life Bldg.,
Birmingham.

KENTUCKY STATE DENTAL ASSOCIATION

THE eighty-second annual meeting of the Kentucky State Dental Association will be held at the Brown Hotel, Louisville, March 30-April 3. This will be a homecoming, with alumni class banquets. The last two days will be devoted to postgraduate instruction.

J. L. WALKER, *Secretary,*
640 Barbee Way South,
Louisville.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Kentucky State Board of Dental Examiners will be held June 9-12 at the University of Louisville,

Dental School, Louisville. Dentists having graduated prior to 1942 and desiring to stand examination before this board must file applications, complete with full information requested, at this office not later than March 9. Applications of 1942 graduates must be in the secretary's office by May 9. Ample time should be allowed for securing all data required. For application forms and further information, apply to

LEON M. CHILDERS, *Secretary,*
1312 First Nat'l Bank Bldg.,
Lexington, Ky.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations commencing Monday, June 29 and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules for applicants, instruction sheet and preliminary application blank will be sent. Any person desiring to become a candidate must file the preliminary application, together with the examination fee of $25 on or before March 15 for the succeeding June examinations or before September 1 for the succeeding December examinations.

W. A. WILSON, *Secretary,*
150 East State St.,
Trenton.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

THE next examination for appointment as assistant dental surgeon, U. S. Navy (lieutenant [junior grade], Dental Corps, U. S. Navy) will be held at the Naval Training Station, Norfolk, Va., the Naval Training Station, Great Lakes, Ill., and the Naval Training Station, San Diego, Calif., February 9. Application for this examination should be made to the Chief of the Bureau of Medicine and Surgery, Navy Department, Washington, D. C. Applicants for appointment as assistant dental surgeon must be citizens of the United States, more than 21 but less than 32 years of age at the time of acceptance of appointment, and graduates of a class A dental school. A circular of information listing physical and other requirements for appointment, subjects in which applicants are examined and other data pertaining to salary, allowances, etc., can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C. Assistant dental surgeons are appointed in the rank of lieutenant (junior grade), Dental Corps, U. S. Navy. The pay and allowances for an officer of this rank total $2,699 a year if he has no dependents and $3,158 a year if he is married or has dependents.

LOCATIONS FOR DENTISTS

A NEED for additional dentists exists in many of the vital defense areas. These shortages have arisen because of the great increase in civilian population that has occurred during the year. At present, needs exist in a number of states in communities varying in size from small villages to large cities. A continuing increase in population will result in overtaxing the dental personnel in many other localities where at present the dentists are very near the limit of their capacities. In many of these defense areas, there are defense housing projects in which office space or living accommodations, or both, may be secured. The United States Public Health Service in cooperation with the Division of Defense Housing of the Federal Works Agency, which supervises these projects, is interested in acquainting dentists with the needs of these communities. If you are interested in securing more specific information about localities for the establishment of practice, communicate with

THOMAS PARRAN, *Surgeon General.*

DENTAL RESIDENCY

THE University of Oregon Medical School Hospitals and Clinics offers a residency in dental medicine and oral surgery, the period of service to be one year, with compensation $40 monthly, in addition to board, room and laundry. The division is under the general direction of the department of medicine and the direct supervision of the head of the division and a visiting staff of sixteen dentists. Service is carried on in the outpatient clinic and the three hospitals. Application blanks will be furnished on request. Direct inquiries to

RICHARD B. DILLEHUNT, *Dean,*
University of Oregon Medical School,
Portland.

RESEARCH FELLOWSHIPS IN MEDICINE AND DENTISTRY AT THE UNIVERSITY OF ILLINOIS

THE Graduate School of the University of Illinois has established four research fellowships to be awarded for one year in the fields of medicine and dentistry in Chicago at a stipend of $1,200 per year (calendar year with one month's vacation). Candidates for these fellowships must have completed a training of not less than eight years beyond high school graduation. This training may have been acquired in any one of the following ways, or the equivalent thereof: 1. Work leading to the B.S. and M.D. degrees. 2. Work leading to the B.S., M.S. and D.D.S. degrees. 3. Work leading to the B.S. and B.A. degree in a four-year collegiate course and to the D.D.S. degree. 4. Work leading to the B.S., D.D.S. and M.D. degrees. The fellowship year begins September 1. Formal application blanks can be secured from the Secretary of the Committee on Graduate Work in Medicine and Dentistry, 1853 W. Polk St., Chicago, Ill.

BRONX HOSPITAL VOLUNTEERSHIPS

THE Dental Department of the Bronx Hospital offers a number of volunteerships to recent graduates in dentistry in the following branches: oral surgery and anesthesia; surgical pyorrhea; orthodontia; root canal therapy, and operative dentistry. Those offering satisfactory credentials indicating their interest in the clinical study of dental surgery as a health problem will receive consideration. Address applications to the Dental Department, Bronx Hospital, Fulton Ave. at 169th St., Bronx, New York. Appointments will begin in July.

DAVID WURZEL, *Director,*
Dental Department.

INTERNSHIP APPOINTMENTS

THE Walter G. Zoller Memorial Dental Clinic, University of Chicago, offers four rotating internship appointments, effective July 1, 1942, to June 30, 1943. The clinic maintains four divisions of service: 1. The Zoller Clinic in Billings Hospital for general dental service. 2. The University Dental Clinic in Billings Hospital for diagnosis and minor oral surgery. 3. The Prenatal Dental Clinic in Chicago Lying-In Hospital for general service. 4. The Orthopedic Dental Clinic in the Home for Destitute Crippled Children for general dentistry. In addition to clinical practice, the intern will assist in the department of anesthesia and have the privilege of attending all departmental seminars on dentistry, medicine, pathology, etc. Those seniors interested should write immediately for application blanks to the Director, Walter G. Zoller Memorial Dental Clinic, University of Chicago, Chicago.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is given the title of Carnegie Dental Fellow and, according to his interest, works as a graduate student in one of the departments of the medical schools. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduate Council of the university, Fellows may prepare themselves for the degree of M.S. or Ph.D. Applications should be made to

GEORGE H. WHIPPLE, *Dean,*
School of Medicine and Dentistry,
Rochester, N. Y.

POSTGRADUATE COURSE IN PERIODONTIA

THE New York University College of Dentistry will hold its ninth annual postgraduate course in periodontia for twenty sessions, as follows: Schedule A, morning and afternoon sessions, June 15-26. Schedule B, morning and afternoon sessions, June 15-17; mornings only, June 18-July 8. Fee $100. Course limited to fifteen men. Preference given in

order of receipt of application. The course will include etiology, diagnosis and treatment of periodontal disease; various technics of pocket eradication, with conservative treatment stressed; Vincent's infection; diagnosis of types of bone resorption; mouth manifestations of systemic disease; periodontal foci of infection; toothbrushing; instrumentation; diet; balancing of occlusion; taught by lectures and clinical work, each student treating several cases. Instruction by Samuel Charles Miller, Sidney Sorrin, J. Lewis Blass and the entire periodontia faculty. For further information and application, address the Office of the Dean, New York University College of Dentistry, 209 E. 23rd St., New York, N. Y.

DENTAL RESIDENTSHIP

A TWELVE months' dental residentship is available at the Western Pennsylvania Hospital, Pittsburgh, beginning July 1. The applicant for this position must be a graduate dentist holding a Pennsylvania license and having had the minimum of one year's dental internship in a recognized hospital. A salary of $83.33 per month with maintenance is offered with the position.

J. A. GARDNER, *Chief*,
Dental Department.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING OCTOBER-NOVEMBER 1941

October 7

No. 2,257,861, HENRY H. SAMUELS. Dentist's casting machine.

No. 2,258,126, WILLIAM SLUTZKY. Dental chair appliance.

No. 2,258,142, CHESTER ORRIN PADELFORD. Immobilizing composition for fractures of the human body.

No. 2,258,143, CHESTER ORRIN PADELFORD. Immobilizing product for fractures of the human body.

No. 2,258,207, GLENN D. IRWIN. Artificial denture retainer.

No. 2,258,473, JOSEPH EARL SCOTT. Reciprocal dental grinder.

No. D-129,908, HENRY M. SUTHERLAND. Design for a rotary toothbrush.

October 14

No. 2,258,863, EARL WAYNE REYNOLDS. Method of anesthetizing.

No. 2,258,883, EDWARD P. CRESSLER. Rinser for teeth and gums.

No. 2,259,036, EDWIN R. GOLDFIELD. X-ray apparatus.

No. 2,259,160, CLIFFORD G. GLASER. Orthodontic device.

October 21

No. 2,259,818, EVA M. HAWKINS. Adjustable head attachment for oxygen tubes.

No. 2,259,928, DIMAN B. EATON. Fountain toothbrush.

No. 2,259,981, DAVID AIKEN. Toothbrush.

October 28

No. 2,260,909, NATHAN KAYE. Denture casting flask.

No. 2,261,036, OSCAR H. PIEPER. Unitary dental apparatus.

No. 2,261,059, ROBERTO GRIS. Rotary toothbrush.

November 4

No. 2,261,213, WILLIAM BIERMAN. Syringe adapter.

No. 2,261,230, WILBUR J. COX and EMIL W. STANGER. Surgical apparatus.

No. 2,261,325, ROBERT C. ANGELL. Accessory table.

November 11

No. 2,262,108, JOHN A. LINDE. Orthodontic appliance lock.

No. 2,262,574, EDWARD L. CHOTT. Articulator.

November 18

No. 2,262,982, FRANK E. WOLCOTT. Toothbrush.

No. 2,263,360, LOUIS P. KARSHMER. Toothbrush.

No. D-130,437, ALEXANDER TWIGG PATTERSON. Design for artificial denture cleaner.

November 25

No. 2,263,692, SAMUEL JAMES EVERETT. Hypodermic needle.

No. 2,263,802, ARTHUR GRUSIN. Toothbrush.

No. 2,263,808, FLOYD M. HUTCHINSON. Dental hand piece.

No. 2,263,885, WALTER G. MCGAULEY. Toothbrush.